

ENGINEERING AND PRODUCTION IN METALWORKING

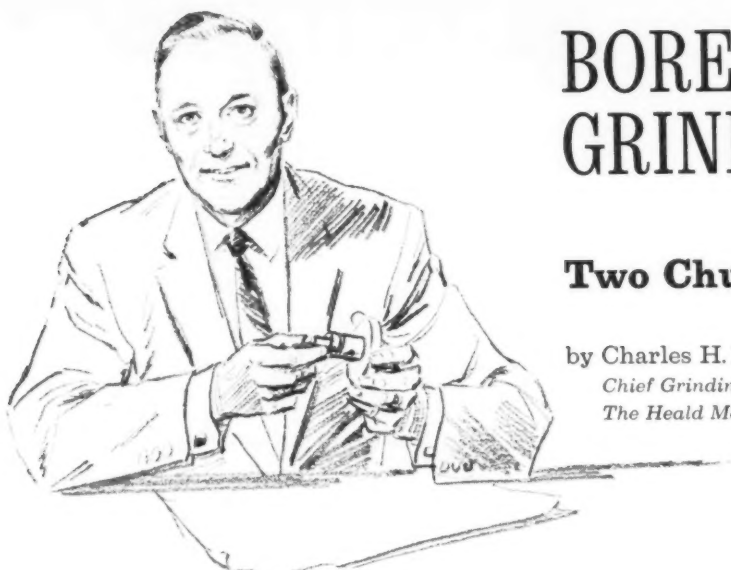
MAY 1961

Machinery



100%
faster production
on the 10,000 RPM
B&S No. 00 Automatic
with high speed
automatic magazine
See page 32

Brown & Sharpe 
PRECISION CENTER



BORE AND FACE GRINDING...

Two Chuckings or One?

by Charles H. Hall
Chief Grinding Engineer
The Heald Machine Company

Many parts that call for an internal grinding operation also require precision finishing on an adjacent or associated face. This poses no particular problem, of course, and it usually presents an opportunity to make substantial savings by combining the two operations on a single machine.

The conventional method of grinding the bore on one machine and the face on another has some inherent disadvantages. It means two separate loading and grinding operations plus additional handling between machines. And since two chuckings are involved, the relationship between bore and face is subject to squareness variations which may or may not be serious.

If, on the other hand, the bore and face can be done at a single chucking, total floor-to-floor time can be greatly reduced. But even more important is the fact that squareness between bore and face can be positively assured.

Combined bore and face grinding has been standard procedure with certain types of work on Heald two-spindle internals for many years. Several different methods can be employed, each of which has its own merits for a particular application.

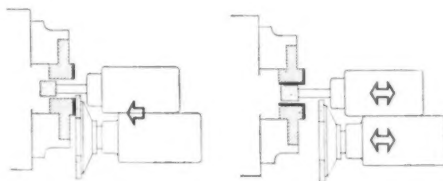
Where cycle time must be kept to the minimum, slide-bar facing offers maximum efficiency and economy, for both surfaces are ground *simultaneously*. One wheelhead unit mounted on anti-friction slide bars holds the facing wheel in grinding position while a second wheelhead unit reciprocates grinds the bore.

Where high production requirements are not a limiting factor, initial machine cost can be lowered by using a two-spindle machine arranged for sequential bore and face grinding, either with or without indexing of the wheelheads. Where bore tolerances are extremely close and indexing is not desired, fixed wheelheads can be arranged to permit

manual plunge facing while the bore wheel enters the work without touching it. The table is then backed off to reciprocate-grind the bore.

Where indexing is permissible, a retractable facing head is often used. After the work is plunge faced, the facing head is retracted and table is indexed to align the bore wheelhead unit with the hole. This arrangement provides maximum versatility and permits the machine to be used as a bore grinder, a face grinder, or a combination of both.

Whatever your requirements for bore and face grinding, it is probable that one of these two-spindle arrangements can be applied with a substantial reduction of initial investment, lower floor-to-floor cycle time and an improvement in quality as well.



Diagrams of sequential bore and face grinding with fixed wheelheads, showing face grinding at left and bore grinding at right.



Diagrams of sequential bore and face grinding with retractable facing head and cross slide indexing, showing face grinding at left and bore grinding at right.



Diagrams of slide-bar facing arrangement showing semi-finish bore grinding and face grinding at left and finish bore grinding at right.

Ask your Heald engineer for further details, or send for Bulletin 2-69-2. It **PAYS** to come to Heald.

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
WORCESTER 6, MASSACHUSETTS

Machinery

MAY 1961

VOL. 67 No. 9

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THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION
IN THE MANUFACTURE OF METAL PRODUCTS

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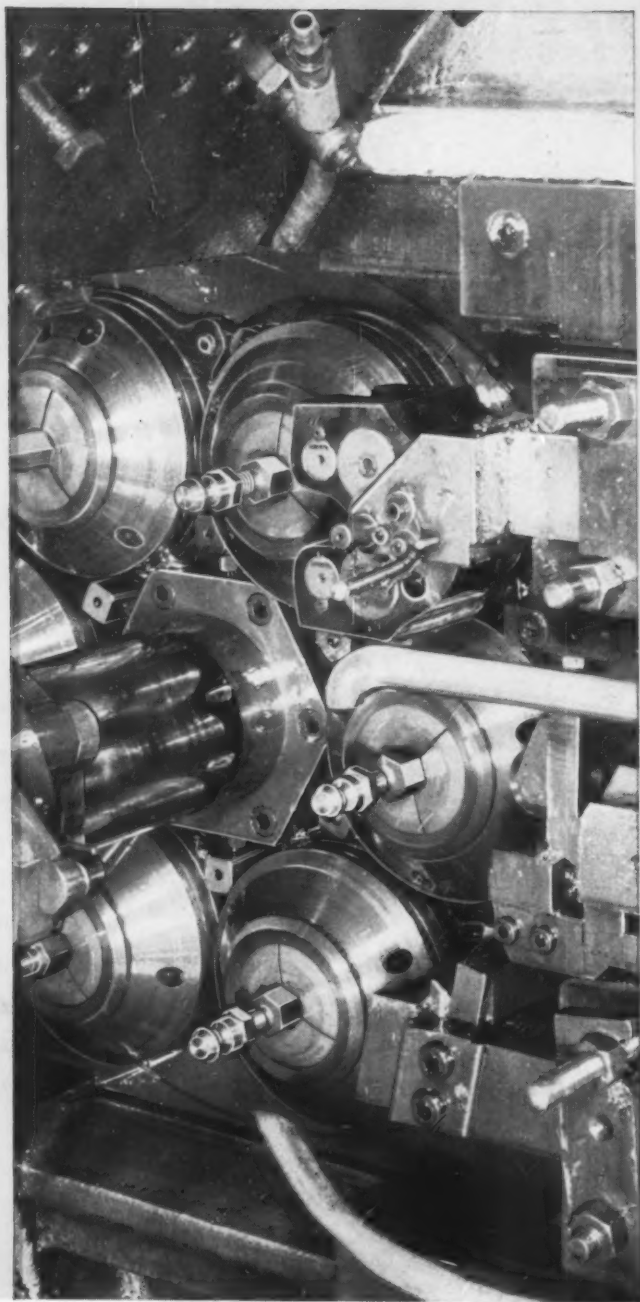
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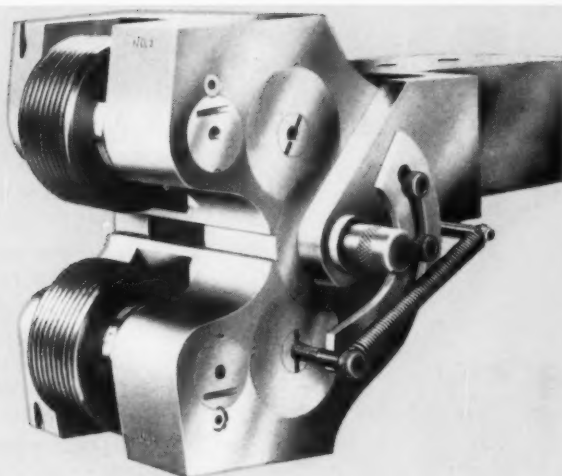


FREE INFORMATION GUIDE

252



thread
roll
cost
only
16 1/2¢
per
thousand
pieces



The LANROLL Thread Rolling Attachment once again has proved its money-saving value . . . this time thread rolling clutch shaft parts at the AL-KEN Manufacturing Co. in Hudson, Mich.

In this operation, the 18GA LANROLL Attachment is mounted at the fifth position of a 1 1/4" Six-Spindle Conomatic and thread rolls 1/2", 13 pitch, UN, Class 2A, 5/8" long threads on B1113 bar stock. Using only one set of rolls a direct cost of 16 1/2¢ per thousand was realized in rolling 250,000 pieces.

Long roll life is but one benefit with the specially stabilized LANROLL Attachment. It also allows rolling of coarse pitch threads to Class 4 tolerances, and will roll threads directly to a shoulder with safety and excellent microstructure of the rolled thread. Other leading features of the Attachment, designed to produce right- or left-hand, straight or taper threads, include: wide range coverage, precise adjustment, attachment tipping to avoid indexing interference, and set-up ease. Primarily designed for application to bar automatics, the LANROLL Attachment can also be installed on the cross slide of a lathe provided power feed is used. For more information ask for Bulletin G-96.

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

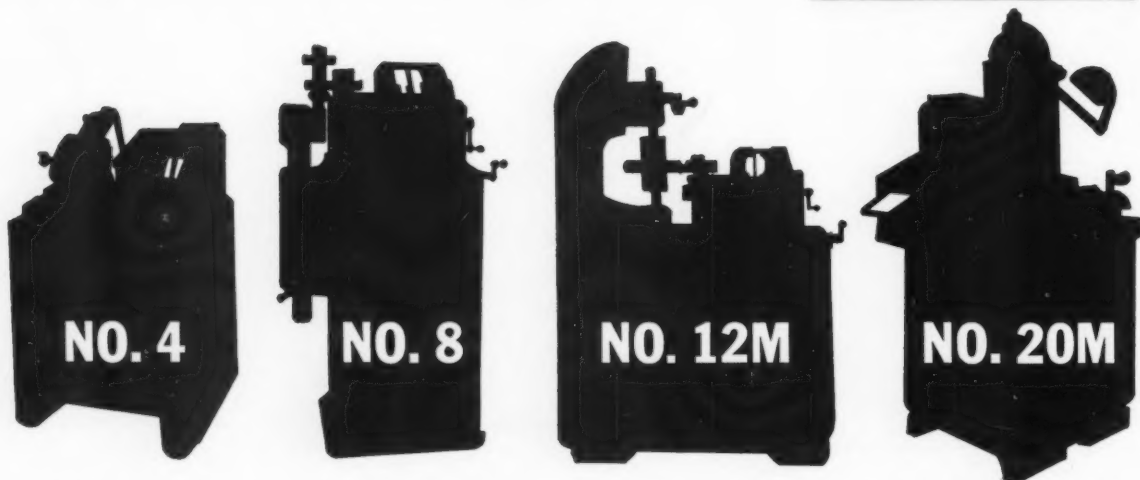
607C

On these pages you'll find the number of the FELLOWS gear inspection instrument that precisely matches your needs.

In fact, right from the gear blank to the finished external or internal spur or helical gear, FELLOWS has a complete line of gear production *and* inspection equipment.

One of the most important FELLOWS developments is the No. 4 Red Liner for fine-pitch gear inspection. It makes "composite" checks on the finest instrument gears with remarkable accuracy and sensitivity. Magnifications of 1600 to 1 are obtained thru the electrical recording system which provides a written, unbiased record for instant reading or for proof-of-accuracy files. It's the *best* way to check tiny gear components such as that shown actual size at top of right-hand page . . . a 22-tooth, 96 D.P. pinion backed up to an 80-tooth gear on a cluster.

WE'VE GOT YOUR



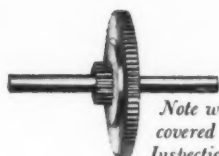
NO. 4 FINE PITCH RED LINER. For composite check of external and internal spur and helical gears. Maximum P.D.—4".

NO. 8 RED LINER. For complete check of external and internal spur and helical gears. Maximum P.D. depends on design.

NO. 12M INVOLUTE MEASURING. For external and internal spur and helical gears. Maximum P.D.—12". No. 24M—24" cap.

NO. 20M RED LINER. For complete check of external and internal spur and helical gears. Maximum P.D.—18".

Keep *your* production and inspection operations efficient and economical with today's most advanced gear manufacturing equipment. Get complete details on FELLOWS equipment from your nearest FELLOWS branch office.



Note wide range of size covered by Fellows Gear Inspection Equipment.

NUMBER!



NO. 12H

NO. 12H LEAD MEASURING.
Continuous-originating type lead measuring of external and internal helical gears. Maximum P.D. —12". No. 24H has 24" capacity.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:

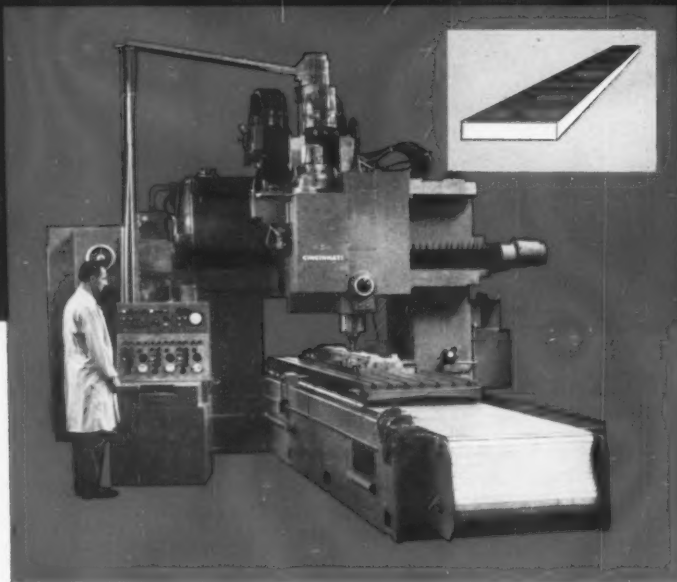
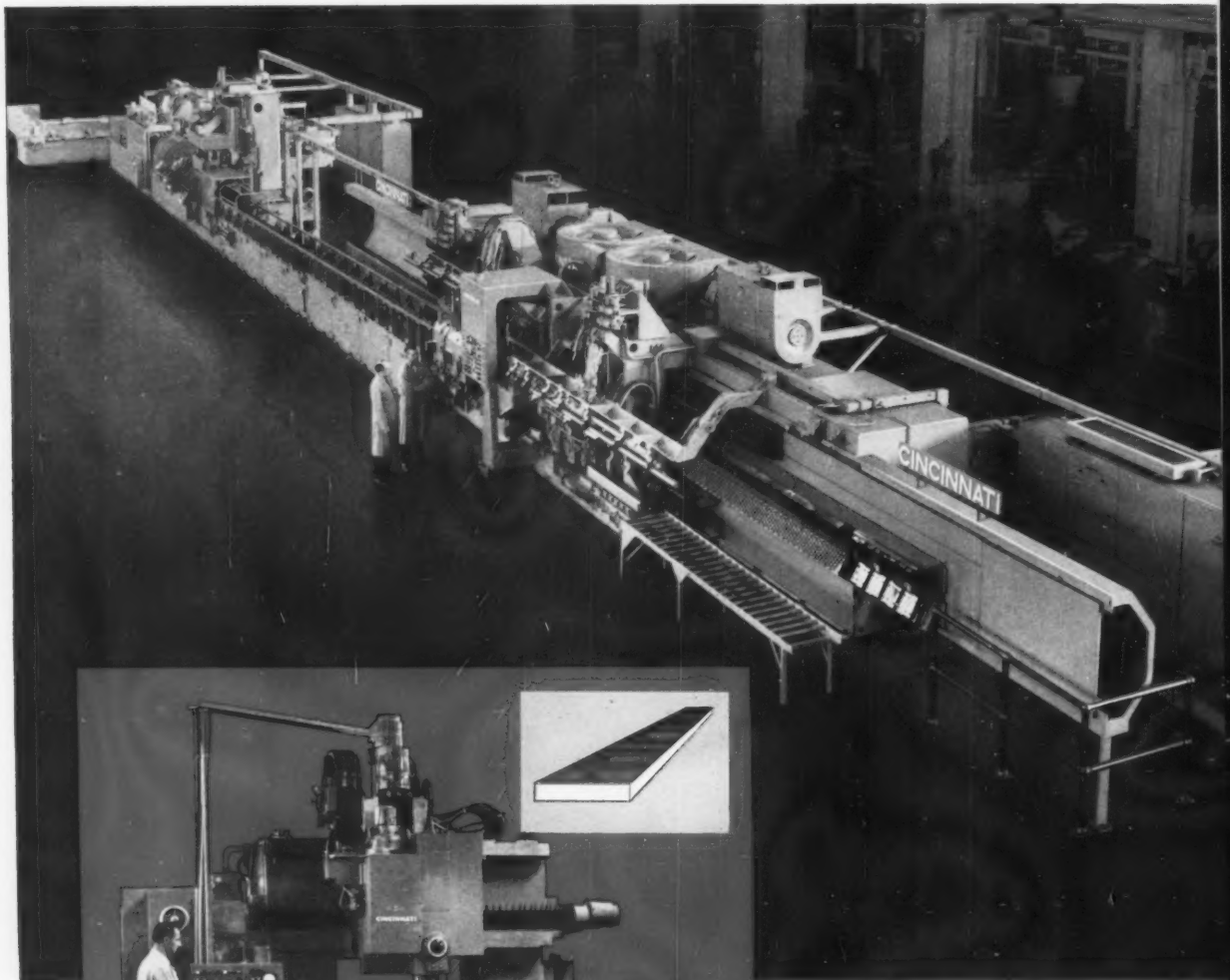
1048 North Woodward Ave., Royal Oak, Mich.
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6214 West Manchester Ave., Los Angeles 45

**THE
PRECISION
LINE**

Fellows

Gear Production Equipment

CINCINNATI GIVES YOU THE ADVANTAGE OF.



CINCINNATI Bridge-Type Profile and Contour Milling Machine with 3-axis numerical control, for milling pockets of an aircraft wing panel beam (shown in inset). This is one of several in a new generation of machines, completely built from the ground up by the Special Machine Division; designed specifically for numerically controlled milling on a variety of aerospace and general-purpose parts made of aluminum, titanium, steel and the new "exotic" materials.

CINCINNATI 36-Station Transfer Line automatically broaches, mills, drills and reams V-type engine blocks . . . all in one continuous operation. Both V-6 and V-12 blocks, made in three different bore sizes, are accommodated with very little change-over. The line incorporates the world's largest horizontal broaching machine, which machines 12 surfaces; manufacturing holes then are drilled and reamed, and 10 surfaces milled. Production, 67 per 60 minute hour.

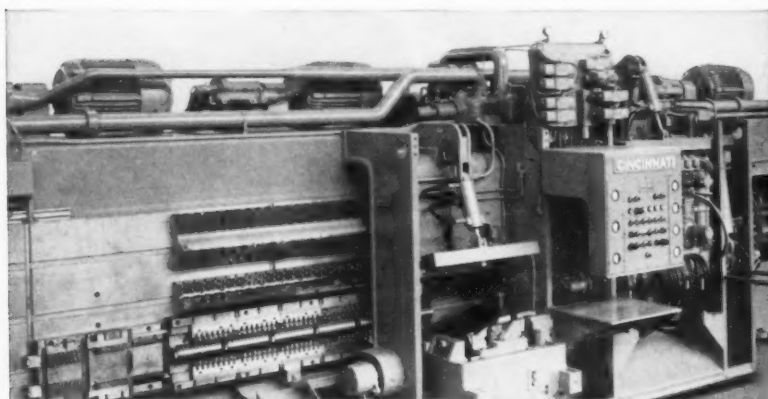
DESIGNERS AND BUILDERS OF SPECIAL MACHINES • HORIZONTAL BROACHING MACHINES •
THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

OVER *45* YEARS' EXPERIENCE

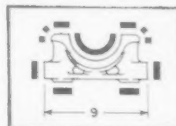
IN DESIGNING AND BUILDING SPECIAL MACHINERY

CINCINNATI MILLING'S SPECIAL MACHINE DIVISION has the broad experience and engineering talent to design and build special machinery and process equipment of any size and complexity. Here your production requirements receive the attention of specialists in every phase of activity . . . from the integration of numerical control to application of the cutting fluids. **ENGINEERING SERVICE**, a Cincinnati contribution to industry since 1912, analyzes your problems thoroughly and prepares engineering proposals and cost estimates. Other functions of the Special Machine Division include special design engineering and product development . . . manufacture, assembly and inspection . . . factory run-off, using customer samples . . . demonstration and follow-up of equipment in customer's plant.

Highly successful installations by the Special Machine Division are reducing costs in many industries—metalworking, paper, chemical, optical and others. Much of this equipment incorporates the advantages of automation and numerical control. Want specific job application data? Simply present your production problems to our Field Engineers. Write or telephone today. **Special Machine Division, The Cincinnati Milling Machine Co., Redwood 1-2121.**

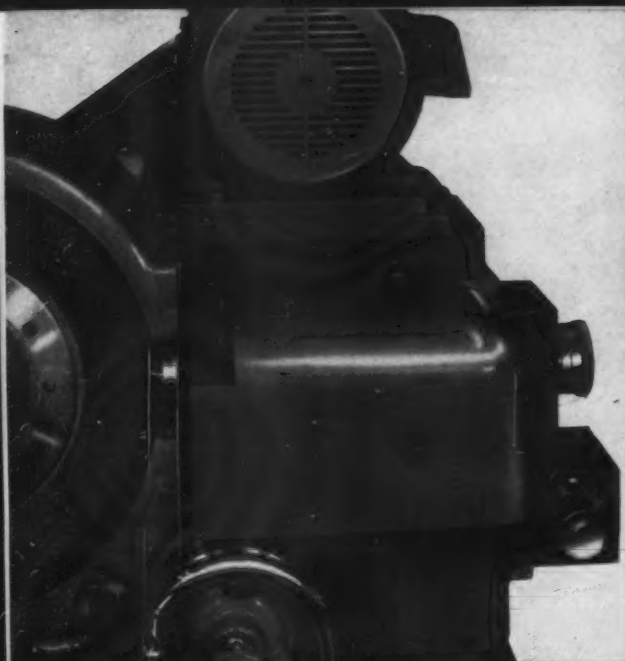


CINCINNATI Horizontal Hydro-Broach Machine broaches 13 sizes of main bearing caps at a production rate of 80 per 48 minute hour. Broached surfaces are indicated by heavy lines in drawing of part at right. The Special Machine Division utilized throw-away tool bits as one of the many plus factors in reducing the cost of this machining operation. In actual production, tool bits are indexed every 24,000 to 29,000 parts, using a total of eight cutting edges before discarding.



COMPLETELY AUTOMATED PRODUCTION LINES

CINCINNATI®
SPECIAL MACHINE DIVISION



New dressing accuracy . . . Landis Truform dresser with preloaded ball slides, gives exact duplication of the profile on the wheel.



Faster grinding cycles . . . New and exclusive Landis Lockspeed drive for regulating wheel gives quicker sparkout and rounder work.

Four outstanding advantages of





Greater machine stability... surface plate ribbing of cast bed maintains perfect alignment of ways for both wheelheads.



Close tolerances... work rest solidly mounted on bed with support directly to the base for heavy stock removal without loss of accuracy.

the all NEW Landis centerless grinder

This completely new 12R machine is the finest centerless grinder available anywhere in the world. It will grind parts at a faster rate and to even closer tolerances than was possible before.

LANDIS

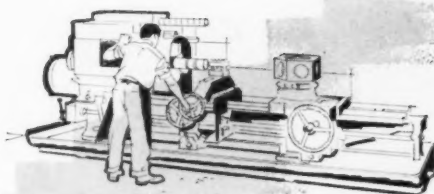
world leader in precision grinders

LANDIS TOOL COMPANY, WAYNESBORO, PA.



The job illustrated is typical of work where large amounts of metal are removed. For example, one forging was reduced from 1850 lbs. as forged to 890 lbs. after machining. Material AISI-1045. Floor-to-floor time: 5¼ hours including setup and gaging.

AT CANN & SAUL STEEL COMPANY
Royersford, Pa.



80 lbs. of metal turned from this forging in 3 minutes

Warner & Swasey 36" swing 5-A in progressive forge shop cuts metal full time at maximum rates yet provides fast handling for small lot production.

The 5-A turret lathe has the power and the rigidity to hog metal at this clip yet the same machine finishes work to .002" or less for Cann &



Rough forgings machined by the Cann & Saul Company include medium carbon steels, stainless, titanium and other alloys, and frequently are heat treated to 300 Brinell before machining. Eccentric and interrupted cuts are a stiff test of machine rigidity.

Saul. Heavy metal removal plus the ability to handle one to four-piece lots at low cost on a battery of Warner & Swasey's are but two reasons why Cann & Saul remains a leader in the competitive custom machined forging field. They make good use of the power built into the 5-A Extra Heavy Duty Warner & Swasey turret lathe by taking cuts up to 1" deep at 300 SFPM and .025" feed. The machine's 36" swing and 12½" hole through the spindle accommodates a wide variety of forging shapes.

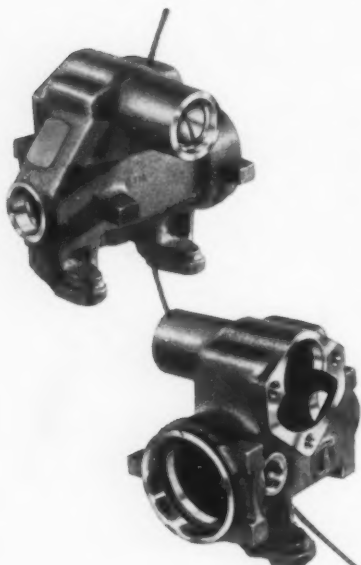
The hydraulic speed shifts and easy handling tool carriages help the operator to handle small lots efficiently...and the work is within easy reach for rapid gaging, an extremely important factor on a big machine like the 5-A.

For more information contact your resident Warner & Swasey Field Engineer, or Warner & Swasey Company, Cleveland 3, Ohio.

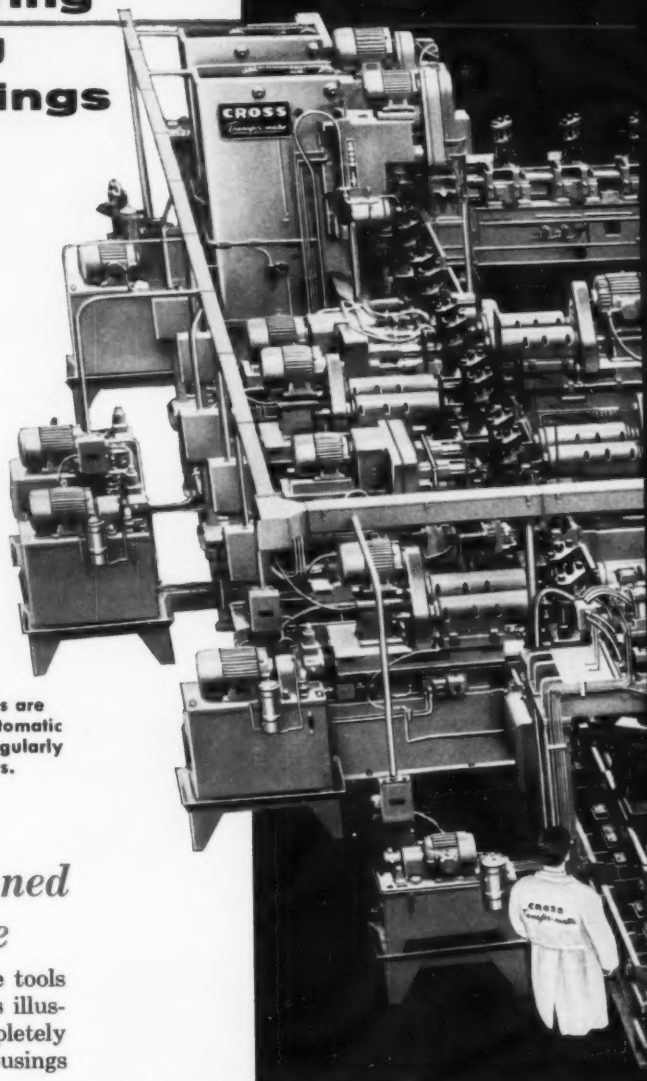
**YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY**



Milling, Drilling, Boring and Assembling Steering Gear Housings



Close tolerances are maintained in automatic processing of irregularly shaped parts.



New Transfer-matic Designed to Prevent Obsolescence

A typical example of how transfer type machine tools can be designed to guard against obsolescence is illustrated by this new Cross Transfer-matic. It completely machines and assembles power steering gear housings except for the mounting feet.

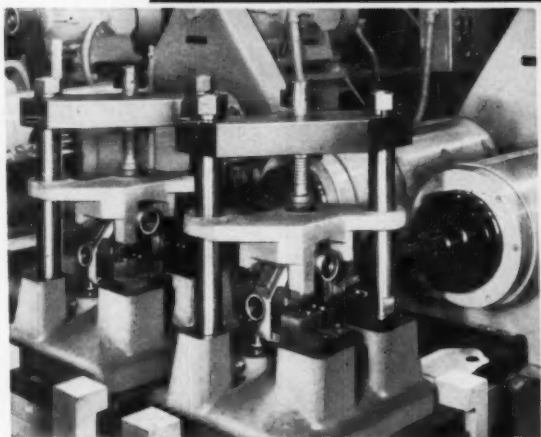
Useful life has been materially increased by building the Transfer-matic to process housings with longer pitman shaft extensions than those now being produced. Three idle stations permit other operations to be added and the use of standard Cross "building blocks" provides further flexibility for part design changes.

Present operations include milling, drilling, boring, counterboring, spot facing, chamfering, tapping, deburring, and assembling the worm thrust bearing cups and the pitman shaft bushings in the housings. Rated production is 300 pieces per hour.

A special feature is the provision for off-line inspection of the pallets and the parts without loss of production.

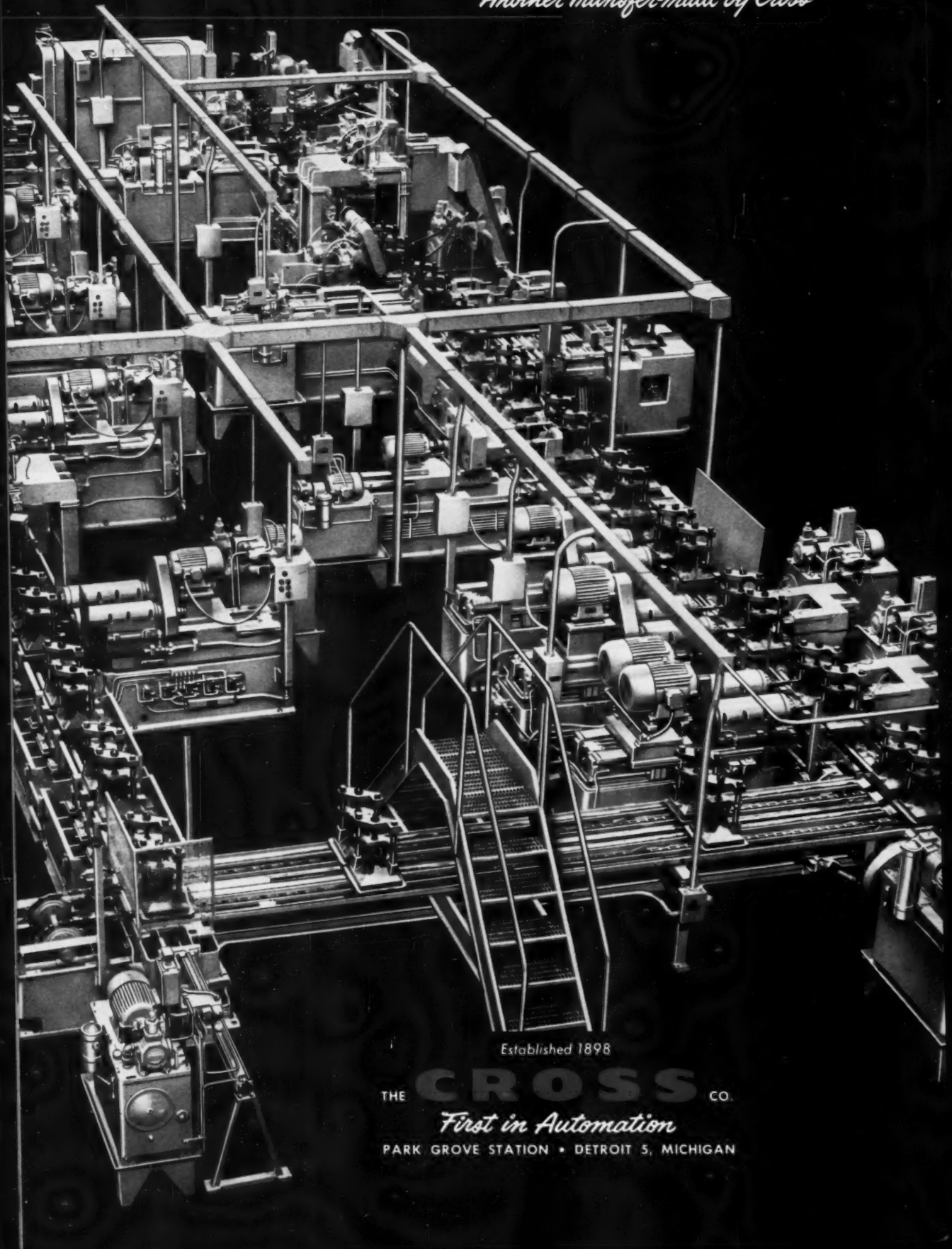
Another feature is the provision for in-line inspection at three different stations and final inspection just before the assembly operations.

If you would like to know more about these and other Cross innovations, just drop us a line.



Precision boring of the worm shaft hole—two at a time.

Another Transfer-matic by Cross

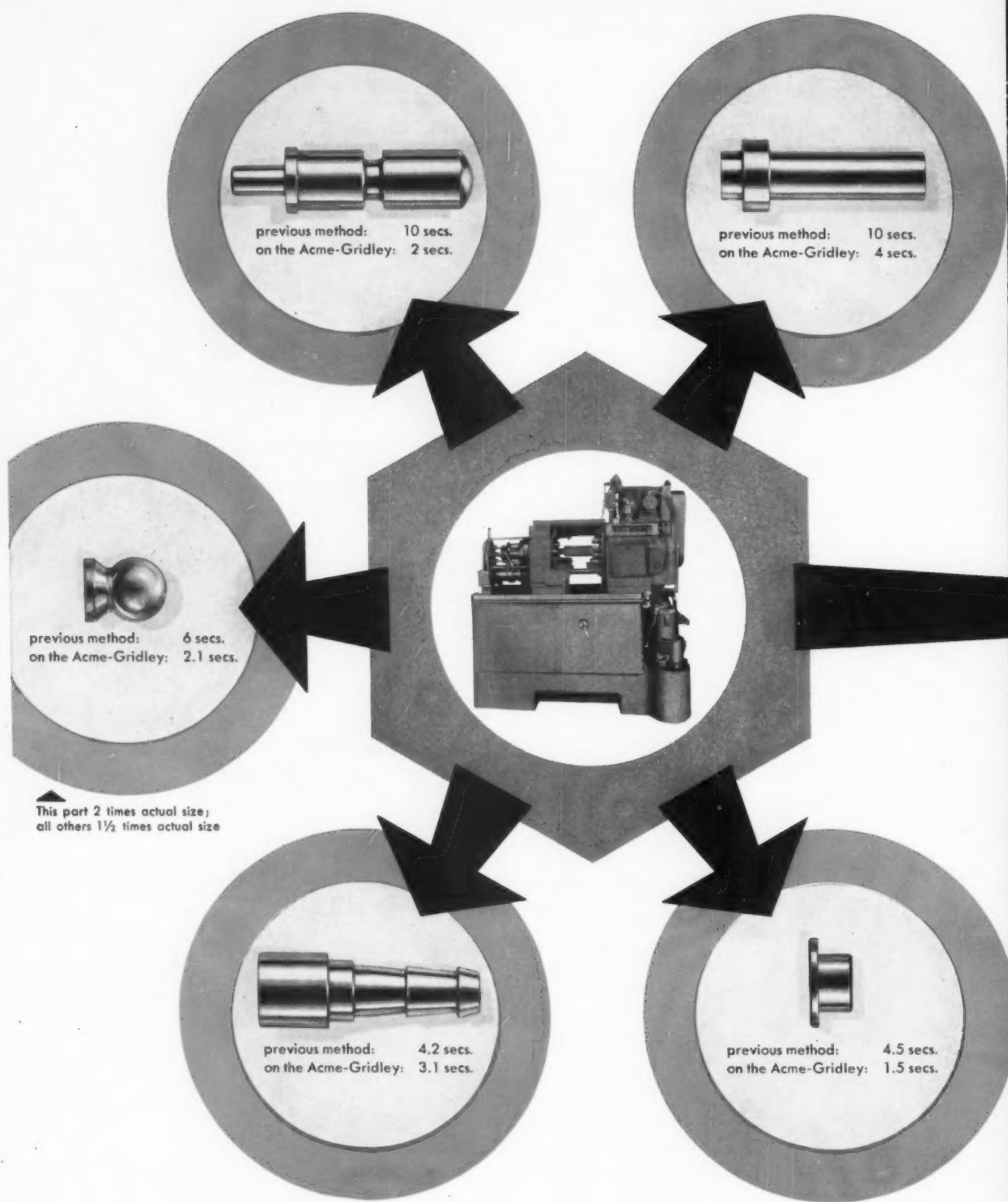


Established 1898

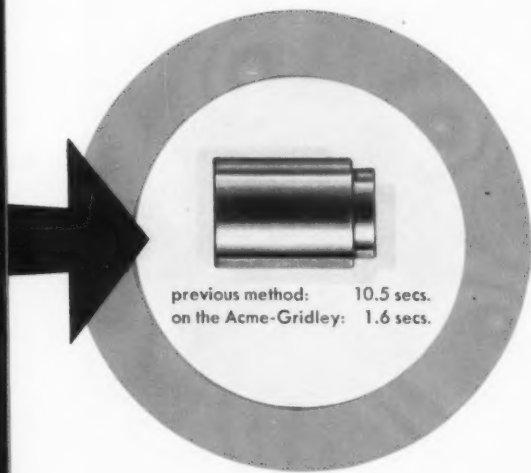
THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



ACME-GRIDLEYS SLASH AVERAGE MACHINE TIME 68%...

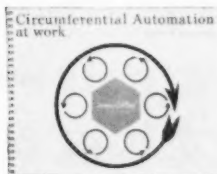


Pay off in profitable new business for screw machine job shop...

Before installing three Acme-Gridley $\frac{1}{16}$ " RA-6 Spindle Automatics, Carleton Screw Products Co. of Minneapolis found it difficult to keep pace with the demand for greater precision and quality required by current manufacturing standards. Consequently, high costs resulting from slow production methods made Carleton less competitive on short run, small part jobs.

With Acme-Gridleys, it's a different story. Short run, small part jobs are Carleton's bread and butter. The Acme-Gridleys cut average machine time 68% and always produce precision parts that surpass customer specs... giving a big boost to Carleton's "repeat order" business.

The $\frac{1}{16}$ " was designed for top economy in the mass production of miniature and sub-miniature parts. It's compact, rugged and has the versatility to handle an amazing variety of jobs. In your shop... for years to come... it will pay off in lower costs and higher earnings.



"Circumferential Automation at Work". For your free copy, call, write or wire.



National Acme

The National
Acme Company
179 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 8, Ill.; Detroit 27, Mich.



Heavily stressed parts made from tough, hardened 4615/20 nickel steels help this Barber-Colman lathe handle heavy work loads with close tolerances.

Nickel alloy steels safeguard the working accuracy of this Barber-Colman lathe

For sustained high-volume production without loss of accuracy...

...here's where Barber-Colman uses 4615/20 nickel alloy steels for vital components:

All these parts are made from AISI 4615 steel (1.8% nickel):

- tailstock spindle
- spindle front cap
- reverse rod bushing
- tailstock binder shaft
- handwheel pinion shaft

And the main headstock spindle is made from AISI 4620, to give this critical component built-in resistance to torsion, fatigue, and frictional wear...

AISI 4615 and 4620 steels, carburized and hardened, provide a hard case for wear resistance, *plus* a tough, strong core to withstand shock-loading. In addition, both possess good resistance to distortion in heat treatment... a positive way to help cut costly finish-machining.

When you order or design machine parts, remember these tough, wear-resisting nickel alloy steels. And for engineering information to help you select the best metal for a particular job, write to INCO, outlining your problem.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street  New York 5, N. Y.

INCO NICKEL

NICKEL MAKES STEEL PERFORM BETTER LONGER

BK bond discs

ELIMINATE BURNING



Gardner cooler-cutting BK discs grind connecting rods without burning or work hardening—raise hourly output by 30%



production data

part	connecting rods
machine	Mattison vertical spindle grinder
rate	.455 parts per hr.
(former rate	.350 parts per hr.)
stock removal:	
rough	.010"-.015"
finish	.005"-.010"

GARDNER
abrasive discs

GARDNER MACHINE COMPANY, BELOIT, WISCONSIN
a subsidiary of Landis Tool Company



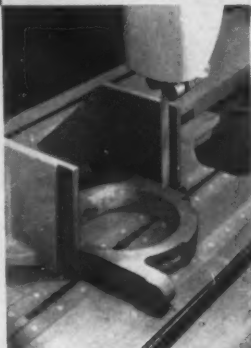
COPING AND MITERING HEAVY STRUCTURAL SHAPE

18" Beam (above) is held between vises for the short cut. On the long cut (left) vises were removed and beam held by simple clamp. The MARVEL Band Saw is truly indispensable in ornamental and structural iron shops where this type of work is done daily. The machine will cut-off square, miter and cope any work shape from the smallest moulding to 18" I-beams.



SPLITTING CLAMP RINGS, BUSHINGS

Splitting clamp rings, connecting rods, bushings and collets is a fast, simple operation on the No. 8 Band Saw. Perfect control, quick chucking facilities, accuracy and speed are features that especially fit the machine to handle this type of work.



MITERING LARGE DIAMETER PIPE

Pipe (or any bar shape) may be mitered at a 45° angle without the need for special jigs or fixtures. Even when cutting miters, work remains in the same position as it does for straight cuts. Column and blade are instantly tilted to desired angle, even without stopping the machine. Perfect miters (or lesser angles) are sawed without any layout or special equipment.

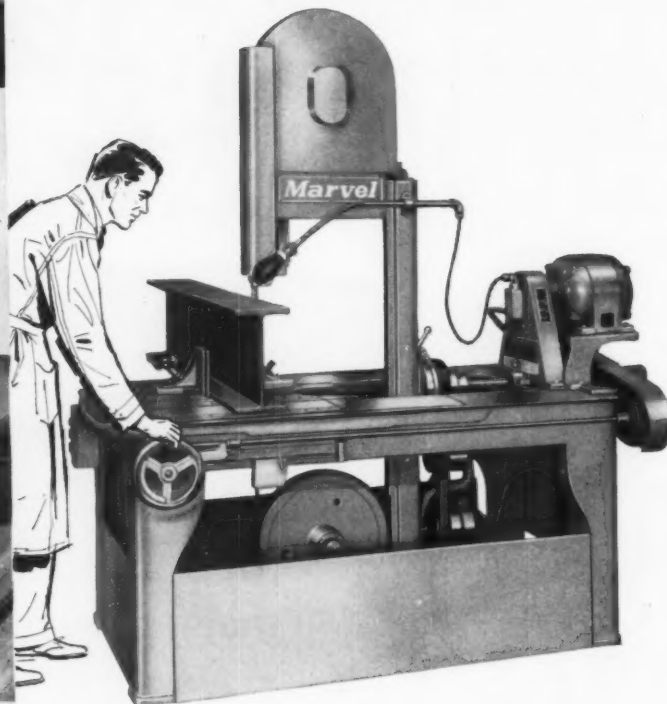


SEGMENTING LARGE DIE BLOCK

Three equally spaced re-entrant cuts were made in this 16" x 18" SAE 4130 Forging. Job was completed, floor-to-floor in 5 hours. No special jigs or fixtures were required. An unusual job that serves to emphasize the versatility of the MARVEL No. 8 Saw.



"The One Machine We Couldn't Do Without"



"As simple to use and handy as a Scout Knife" is the way another user described his MARVEL No. 8 Universal Band Saw recently . . . and we can't think of a better way to describe this versatile metal cutting machine.

With a MARVEL No. 8 Band Saw, you can do almost any conceivable straight, angle, or miter metal sawing job—from cutting-off bar stock to making the most unusual forming cuts. You can handle small, delicate work, and in the next minute, saw structurals, or segment large work as illustrated in the lower photograph. You will save time, labor, and material with a MARVEL No. 8 Band Saw because no other saw has all the features to be had in this truly universal tool.

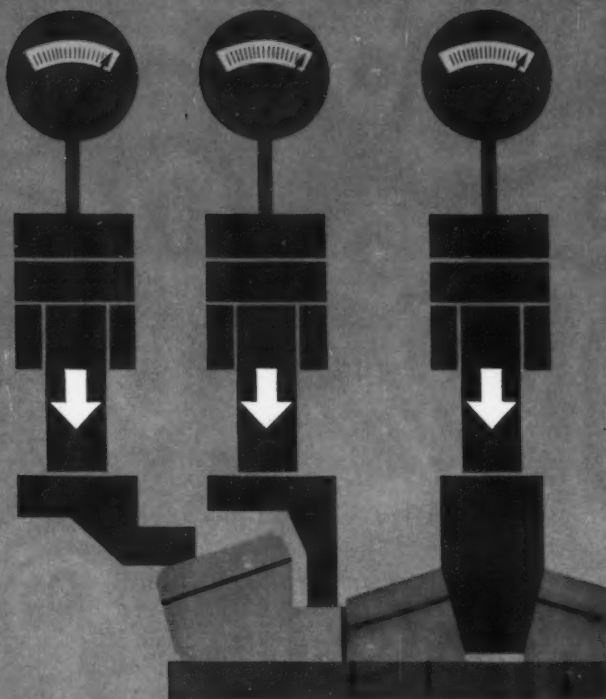
Upright column design and forward travel of the blade through the work (which remains stationary on the table-height saw bed) provides easy, unobstructed visibility and more convenient and efficient working conditions; column can be tilted and locked at any angle up to 45° left and right of vertical; the exclusive MARVEL Power Feed with Automatic Overload Relief; Automatic cutting-depth stops; simple, convenient operating controls—these are some of the features which make the No. 8 Band Saw the most useful—and used—metal cutting saw on the market.

For the complete story, ask or write for Bulletin 875 which illustrates and describes MARVEL Universal Metal Cutting Band Saws.

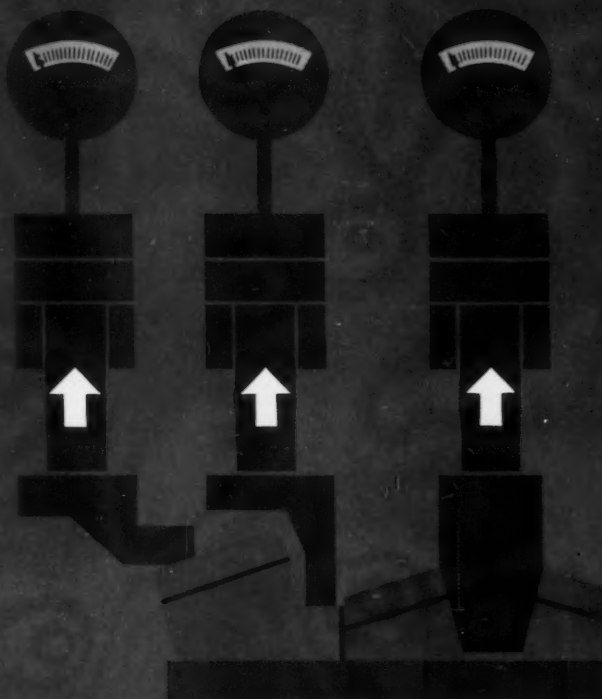


ARMSTRONG-BLUM MFG. CO. 5700 N. BLOOMINGDALE AVE. • CHICAGO 39, ILL.

PULSING PRESSURE ON



PULSING PRESSURE OFF



New Quenching Machine pulsates to eliminate distortion

The pulsing feature of the No. 529 Quenching Machine allows the use of high pressures to control distortion of parts under quench. Pulsing, which is a way of alternately applying and releasing pressure on the part, allows for the natural contraction of the part . . . and eliminates stresses in the part-die relationship.

You get tremendous latitude in control of the quench, since as much as 200 gallons of oil can be pumped over the parts.

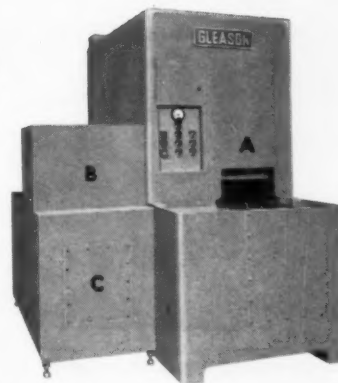
Simply preset the oil flow with valves and timers, and you have the following automatic cycle: start with a fast quench

to set the part, switch to a lower rate; then finish with a rapid quench or vary the sequence any way you wish.

The hydraulic system has a maximum of 1000 pounds of pressure per square inch; a combined total of 50,000 pounds of pressure is available on this machine.

You can handle parts up to 10½ inches in diameter and 4 inches high in the No. 529 Quenching Machine. And it is available in three variations; by adding units as shown in the caption, production is greatly increased.

Drop us a card, and we'll send you more data on specifications and operation.

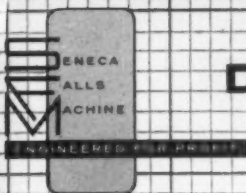


The basic No. 529 Quencher (A) is manually loaded and unloaded. Automatic unloading (B) is easily added. An auxiliary quench chamber (C) can be added for high production work.



GLEASON WORKS

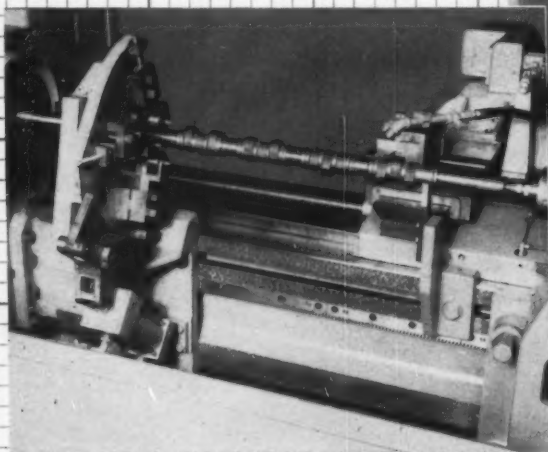
1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.



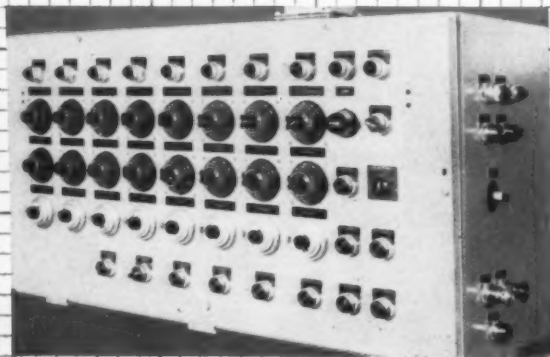
DIAL INPUT NUMERICAL CONTROL PROVIDES FAST JOB CHANGEOVER

ONLY 3 TO 4 MINUTES

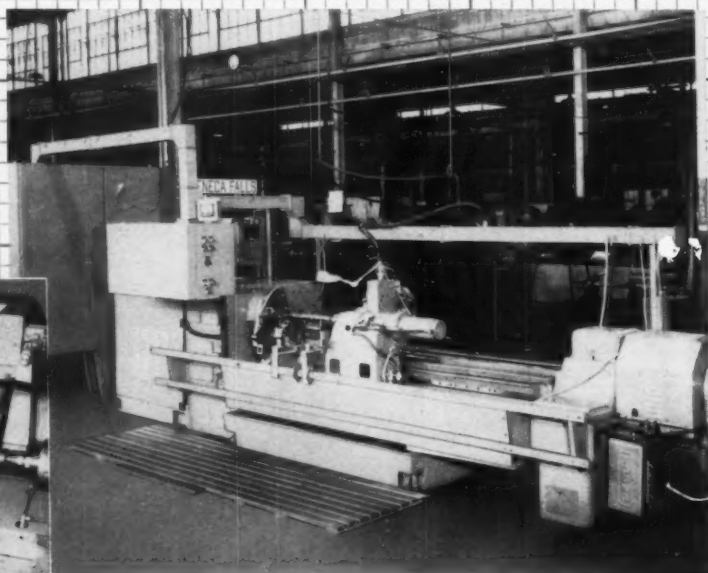
required to program for machining of any one of thirty-five different diesel engine camshafts.



MACHINING CONSISTS OF a qualifying cut on five intermediate and two outboard bearing diameters. This enables the parts to be completed in one simple operation and eliminates a green grind.



THE OPERATOR MERELY SETS INPUT DIALS for diameters as well as *start-cut* and *end-cut* positions of each bearing. No template is required.



This job application thoroughly demonstrates the versatility and production efficiency of the Seneca Falls Model LQ Automatic Tracer Lathe coupled with the Seneca Falls Simplified Numerical Control System.

The machine is equipped with a 90° turning carriage for Y axis feeding of the cutting tool into unique *diameter* positions. *Start-cut* and *end-cut* positions on the X axis are determined by point-to-point rectilinear controls with the reference being the face of the spindle nose.

The complete, multi-pass machining cycle is programmed for automatic operation on any given job by simply setting the calibrated dials on the control panel. A series of eight rows of dials is seen on the illustration at lower left. A row of three dials controls the geometry of each bearing. The top dials control the *start-cut* positions; the center dials, the *end-cut* positions; and the bottom dials, the unique *diameter* requirement for each individual bearing. Dial settings for each job are determined by the Methods and Processing Department so that operator changeover time is but three to four minutes.

Production at 100% efficiency on the six cylinder camshaft illustrated is twenty-three pieces per hour. Accuracy of plus or minus .001" is maintained on all seven bearing diameters.

Let us put this same production engineering know-how to work for you. Tell us about your turning and automation problems. Short run, frequent changeover...heavy stock removal...accuracy and finish...costly handling? We have solutions.

Write for Bulletin Q-59



SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

DO YOUR OPERATIONS DEMAND ACCURATE CENTERS?



Ex-Cell-O Center Lapping Machines Increase Accuracy, Reduce Scrap!

Precision Center Lapping Machines remove heat-treat scale, and eliminate roughness and distortion of centers to insure accuracy in subsequent operations.

Easy to use and modestly priced, Center Lapping Machines include as standard, inbuilt equipment Ex-Cell-O Precision Spindle and manual diamond dresser.

See your Ex-Cell-O Representative, or write for Bulletin 40271.

BEFORE LAPPING

- Out of line
- Out of round
- Incorrect angle
- Rough or torn



AFTER LAPPING

- Perfect alignment
- True roundness
- Precise angle
- Mirror-smooth



60-37

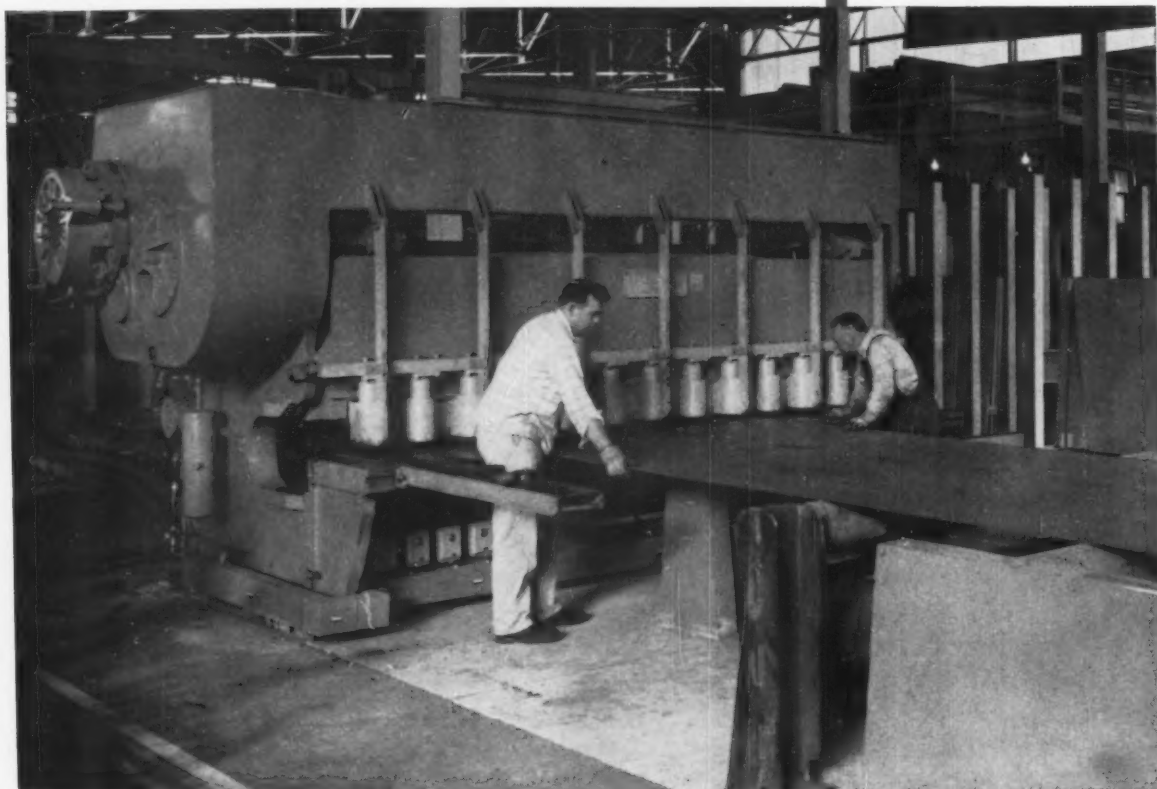
EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O
CORPORATION
DETROIT 33, MICHIGAN

METALS WAREHOUSE CHOOSES STEELWELD SHEAR



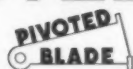
Shearing A7 carbon plate $\frac{1}{2}$ " x 96" x 30'. This is a mechanically operated 12E-12 Steelweld Pivoted-Blade Shear.

Proves Highly Advantageous in New Berkeley Warehouse of Ducommun Metals & Supply Co.

VERSATILITY, speed, accuracy and ease of operation were dominant factors that led Ducommun Metals & Supply Co. to select a Steelweld Shear for its new metals warehouse in Berkeley, California.

Write for free MECHANICAL SHEAR CATALOG No. 2011
or HYDRAULIC SHEAR CATALOG No. 2030

STEELWELD



Mechanical and Hydraulic
SHEARS

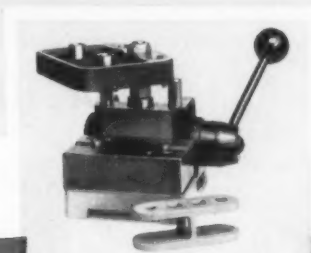
Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes,
One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

-- Ducommun's report on the shear follows: --

1. Used for: A7 plate $\frac{3}{16}$ " to $\frac{3}{4}$ " x 12 ft.
Aluminum plate $\frac{3}{16}$ " to $\frac{3}{4}$ " x 12 ft.
Stainless plate $\frac{1}{8}$ " to $\frac{1}{2}$ " x 12 ft.
Brass & Copper $\frac{3}{16}$ " to $\frac{3}{4}$ " x 8 ft.
2. An important advantage is ease of shearing a wide variety of types and sizes of metals each day from thin narrow strips to heavy, wide plates. The knife clearance adjustment, plus the fast and accurate power back gage, makes changes from one thickness and size to another very fast, yet permits us to produce high quality shearing.
3. Another reason for selecting the Steelweld Shear was the low rake angle of the blade. This permits flatter shearing.
4. The power back gage offers a plus factor in that we can use it in conjunction with our front feed rolls to back off plate for accurate alignment when shearing to a front gage.
5. When the Steelweld Shear was being installed, our sheet shear was being re-located in the warehouse, and we could not shear an order for 26 gage stainless. With the Steelweld knife clearance adjustment, we were able to shear the material very accurately with a minimum of burr.
6. Operator is very pleased with ease of operation and the many adjustments available.

STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 5461 E. 282 ST. • WICKLIFFE, OHIO

Another production time-saver from Ex-Cell-O . . .



LIFT-SWING: the answer to tough drilling jobs!

Available in a range of sizes for short-run and volume drilling, reaming and tapping, Ex-Cell-O's new Lift-Swing Drilling Fixture loads and unloads in seconds, and is precision-machined for 90° "tumble-jig" setups.

Patented "swing-away" top plates swivel for access to the part, and permit a variety of easily tooled jobs; double top plates let you drill stepped holes, or adjacent holes with minimum wall thickness, regardless of bushing wall size.

Your local Ex-Cell-O Representative or Distributor will gladly show you how low-cost Lift-Swing Drilling Fixtures save tooling time and fixture costs, or contact Ex-Cell-O direct for details: Phone TOWnsend 8-3900; TWX—DE 876; Wire ZTC.

**COMPONENTS FOR ALL YOUR JIG AND FIXTURE NEEDS—
AVAILABLE IMMEDIATELY FROM A SINGLE, RELIABLE SOURCE!**



Micron Sections—
Machined cast-iron shapes
cut to order.

Drill Jig Bushings—
Carbide or steel for metal
and plastic jigs.



Fixture Components—
Clamp assemblies and fixture
details.

Reader Service Card Number is for Lift Swing literature only.
Request literature on above items separately.

EX-CELL-O FOR PRECISION

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Bushing Sales Division

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN



But what about the **RELIABILITY FACTOR** in the selection of tool and die steels?

More output per grind . . . steady, high volume production at low cost . . . these are tooling benefits you look for on the job. They stem from the basic quality built into these three Carpenter MEL-TROL® Air-Hardening Tool and Die Steels . . . VEGA-FM, No. 484-FM, and No. 610-FM. Yet, good toolmen know that dependable performance hinges on still another factor: a sound, reliable way to select the right steel for each job. Here's exactly why Carpenter's Matched Set of Air-Hardening Tool and Die Steels gives you a tooling plus: You select quickly and accurately from just three grades to get the exact properties you need for almost any air-hardening application—maximum wear resistance (No. 610), maximum toughness (Vega), or a good combination of hardness and toughness in No. 484.

What's more . . . you know in advance that the steel you select will "deliver the goods". And realize, too, that these three steels are carried in ample stocks for quick delivery from your nearest Carpenter SERVICE-CENTER.



Carpenter steel

you can do it **consistently** better with Carpenter Tool and Die Steels



The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

NOW—An Automatic Form and Groove Grinder . . . designed for tomorrow's production requirements!

WORKPIECES—Standard Ex-Cell-O Model 973 takes parts up to 24" long. Can be equipped for parts with 36" centers. Workhead adjustable for angular settings.

OPERATIONS—Precision-built for rough, semifinished or finished production grinding.

CONTOURS—Grinds straight, angular and radius grooves, and a variety of forms. Grinds multiple grooves when fitted with two or more wheels.

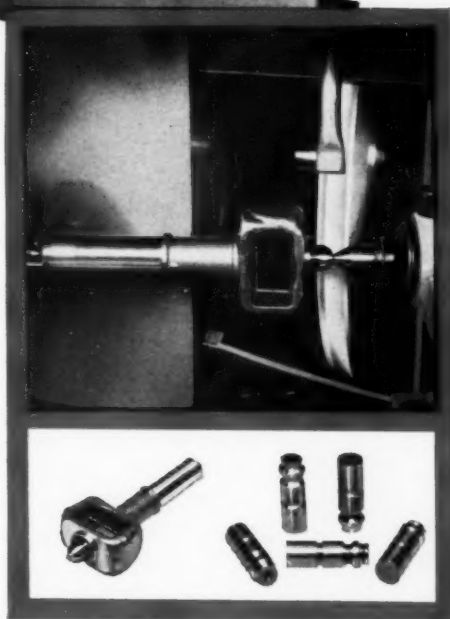
CYCLING—Fully automatic cycling, including opening and closing hood. Rapid wheel slide advance and return for maximum productivity.

SIZE CONTROL—Automatic wheel dressing after each cycle or any number of cycles. Automatic wheel size compensation after each dressing. (Handwheel graduated to .0002" for manual setting.)

DRESSERS—Designed for use with all standard Ex-Cell-O Diamond Dressers, or any special rotary diamond-set wheel dressers.

ACCESSORIES—Model 973 is a complete, versatile machine with extensive automatic features. However, it is designed to be easily equipped with automatic work loading and unloading devices, air operated chuck and tailstock and other accessories to meet your special requirements.

DATA AVAILABLE—Contact your local Ex-Cell-O Representative, or write direct for descriptive literature and engineering data.

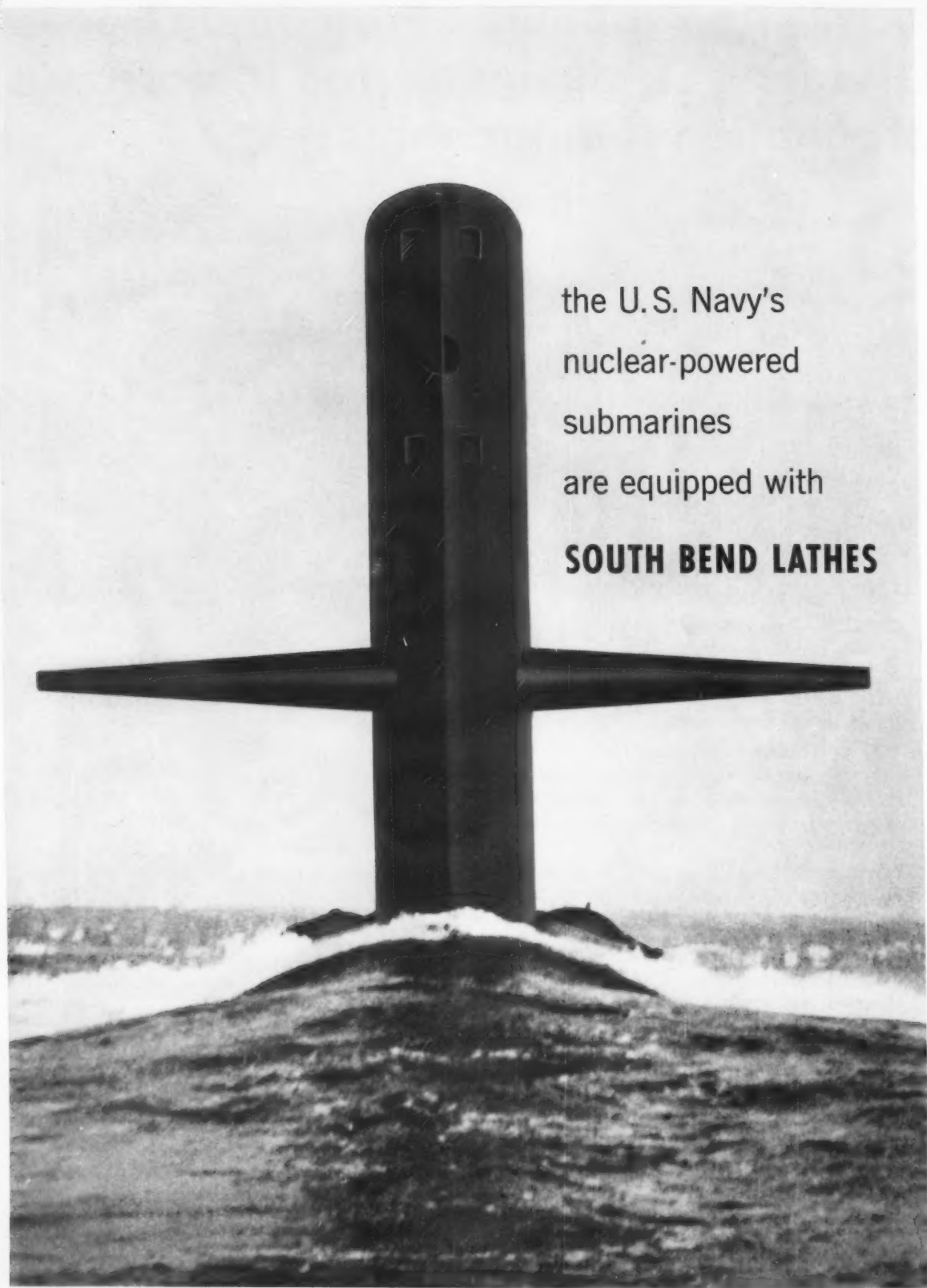


EX-CELL-O FOR PRECISION

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Machinery Division

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN



the U.S. Navy's
nuclear-powered
submarines
are equipped with
SOUTH BEND LATHES

Official U.S. Navy Photograph

NOW A Continental Counterbore Set for New Standard Socket Head Screws!

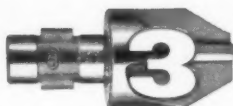


Designed especially for the stronger, safer 1960 Series socket head cap screws, the Continental No. 1B Standard Toolroom Set provides a wide range of sizes in a cost-saving, space-saving tool set. Supplied in a sturdy, fitted oak box, and equipped with a complete lineup of tools in the most-used sizes, the No. 1B gives you traditional CTW

quality and performance for toolroom or job shop counterboring, spot-facing and countersinking operations.

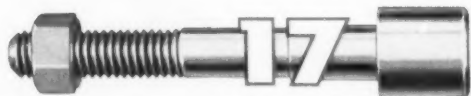
Call your local Ex-Cell-O Representative, or contact Continental Tool Works for details on the full line of CTW Counterbore Sets, and standard and special cutting tools and broaches.

STANDARD TOOLROOM SET NO. 1B CONTAINS:

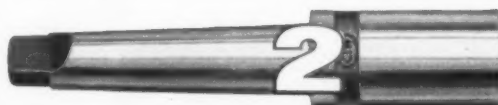


10 hand-detachable CTW Counterbores for #6 through $\frac{5}{8}$ " dia. screw heads.

3 self-centering, hand-detachable CTW Countersinks.



17 hardened and ground counterbore pilots.



2 CTW Holders with non binding, "twist of the wrist" release action. (Available with Morse taper or straight shank.)

"No one has ever reported failure of a Continental Counterbore Drive!"

60-60

Continental

CTW

TOOL WORKS

DIVISION OF

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

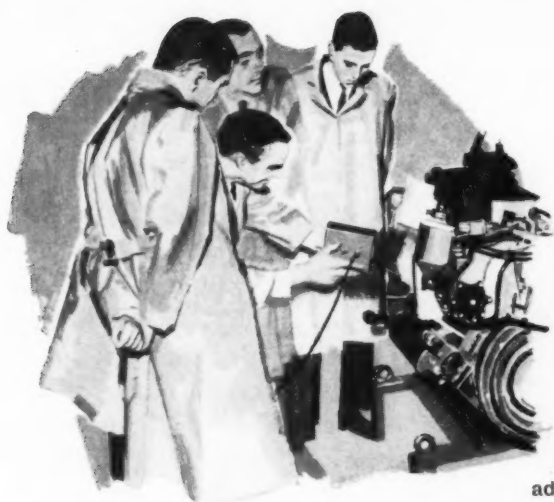
**This
is
AMERICAN
OIL
COMPANY**



A sales organization
especially trained to
serve industrial and
fleet customers . . .
74 District Offices
and 13 Regional Of-
fices . . . 4,100 ware-
houses and distri-
bution points . . . 12
refineries . . . more
than 2,000 products
to serve you . . .
this is American Oil
Company.



● Regional Offices
● District Offices



— The American Oil Company representative who calls on you receives special training in servicing industrial and fleet customers at our Sales Engineering School. His training begins with a concentrated course in petroleum product quality and application. According to a planned schedule, he returns for an advanced course and then again for post-graduate work. — From our Marketing Technical Service Department, your American Oil representative draws assistance, when needed, from specialists who are recognized authorities in their fields. These specialists may be called in at any time to work with you on your lubrication problems. More than a thousand research scientists and technicians at our research laboratory support the effort of our representative to serve you. Their mission: To help your American Oil representative help you lower your maintenance costs and stretch your maintenance dollars. — Learn more about American Oil, its men, its service, its products.



AMERICAN OIL COMPANY
910 S. Michigan Ave., Chicago 80, Ill.



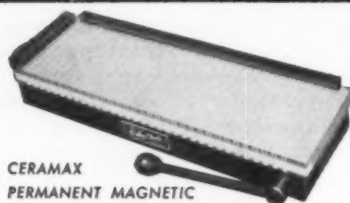
STANDARD ELECTRIC CHUCKS



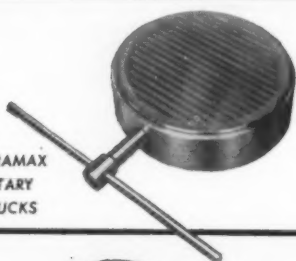
LONG AND
TRANSVERSE
BAR POLE CHUCKS



VACUUM CHUCKS



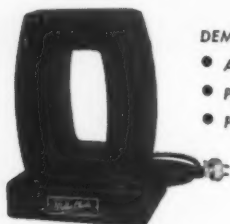
CERAMAX
PERMANENT MAGNETIC



CERAMAX
ROTARY
CHUCKS



ROTARY
ELECTRIC
CHUCKS

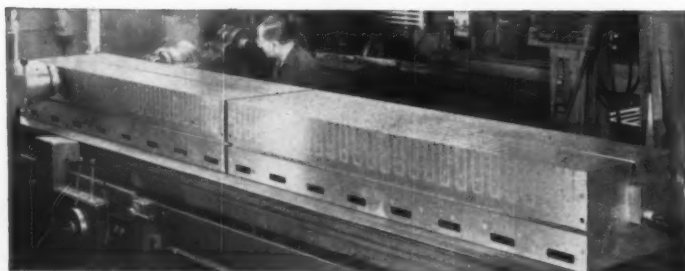


DEMAGNETIZERS

- APERTURE
- PLATE TYPE
- PORTABLE

Walker - - - with **EVERYTHING**

Stop at the Walker Booth (No. 2418) to see first hand the wide selection of magnetic chucks and other magnetic holding devices Walker has available for the metal working industry. You'll see the new Walker Electroperm Chuck, which combines permanent magnets and electric coils to permit holding large ferrous workpieces without heat distortion; the new Walker Ceramax Chucks, the new Walker Top Plate that gives wider latitude to sizes of workpieces that can be worked on Ceramax Chucks — also, the new Walker low frequency Demagnetizer that permits deeper penetration into large workpieces such as engine heads and die blocks. These, as well as many standard Walker Chucks and demagnetizers will be on display. Even if your requirements don't fall within Walker's standard product applications, a Walker representative or engineer will be on hand to explain how Walker has solved hundreds of special magnetic holding problems and can help you, too. In fact . . . it's a good bet that at Walker's booth you'll find the perfect answer to any magnetic holding problem you have.



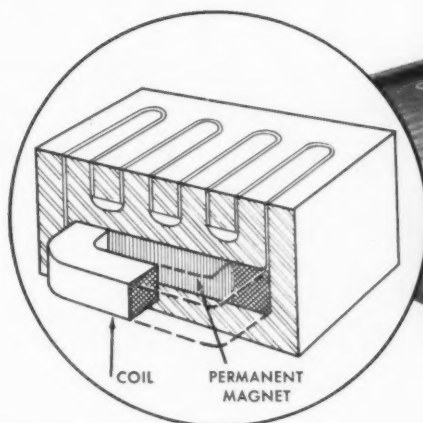
SPECIAL CHUCKS FOR
SPECIAL APPLICATIONS

Catalogs and other descriptive literature will be available.

O.S. Walker
COMPANY, INC.
ROCKDALE ST., WORCESTER, MASS.



will be at the **ASTME SHOW** **BOOTH 2418**
for **MAGNETIC HOLDING!**



New
COLD OPERATING
ELECTROPERM CHUCK

For the first time, a cold operating magnetic chuck is available in all larger standard sizes up to 42" x 96".

Because the new Electroperm Chuck operates cold, precise dimensional stability is main-

tained. The chuck will hold the precision of the machine tool. The chuck is only energized and de-energized electrically, but the permanent magnets provide the holding power. Heat is eliminated.

New - TOP PLATE FOR CERAMAX CHUCKS

Features intermediary magnetic poles to make gap divisions finer. $\frac{1}{8}$ " poles added permits secure holding of

thin work pieces as small as $\frac{1}{8}$ " in diameter. Retention of $\frac{1}{4}$ " poles provide maximum holding for larger pieces.

SEE ALSO AT WALKER'S BOOTH
THESE FAMOUS BUX PRODUCTS:



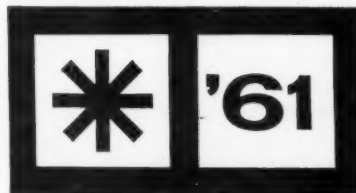
Fast Radial Positioner
for Bux Portable Magnetic
Drill Press

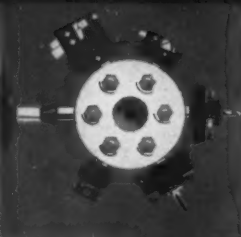
Permanent
Lifting
Magnets



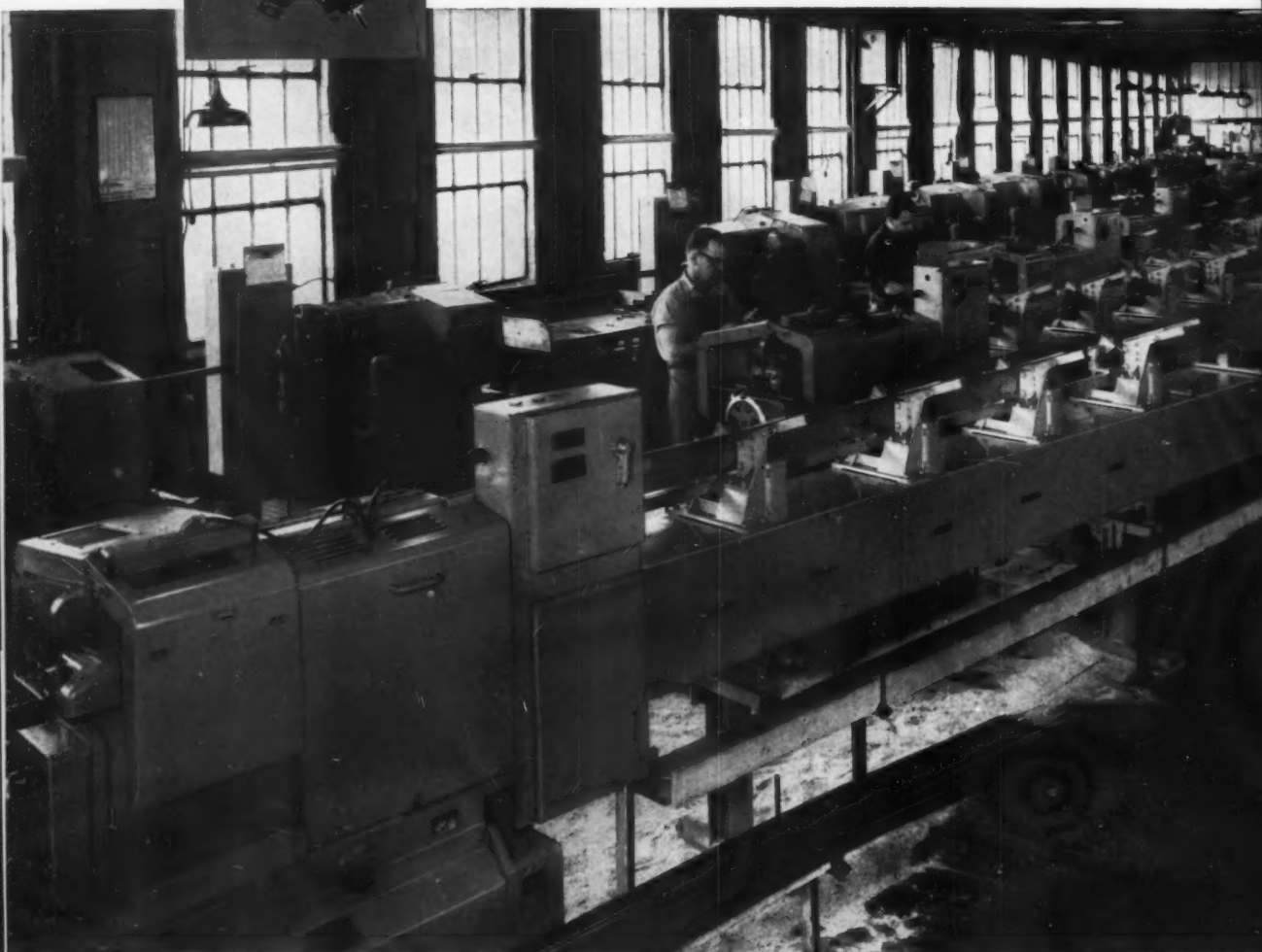
O.S. Walker

COMPANY, INC.
ROCKDALE ST., WORCESTER, MASS.



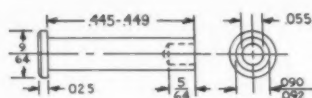


ASK ABOUT THE \$500 TRADE-IN ALLOWANCE ON OLD B&S AUTOMATIC SCREW MACHINES



**100% faster production - $\frac{3}{4}$ second per piece - on
10,000 rpm B&S Automatic with high-speed magazine feed**

BRASS RIVET



With previous equipment		No. 00 Automatic	With new
1½	Sec. per piece	¾	
2400	Pieces per hour	4800	
5000	Cutting RPM	10,000	

Arrow-Hart and Hegeman, leading manufacturer of electrical products, takes full advantage of the cost-saving efficiency of new design Brown & Sharpe Automatics. Hundreds of jobs are now running on the new No. 00 and No. 2 machines. Production gains run up to 60% and more.

Net production of the small brass rivet illustrated has been increased 100%. The new design B&S No. 00 Automatic Forming and Cutting-off Machine used is equipped with a Lip-Rollway Automatic Bar Feed Magazine. The magazine, with a high speed feeding auxiliary, eliminates manual loading and insures 90% efficiency. The remnant is ejected, and the end

of each new bar is squared, automatically.

A 12-foot bar of the 9/64" diameter stock is consumed in 9 minutes. Production is 4800 pieces per hour, as compared with the previous 2400 per hour from old model machines.

Figure the comparable savings you can make with the new design No. 00 and No. 2 Automatics. Get details of the extra speed and precision — the adaptability for combined operations — the faster set-ups and extended tool life that are setting cost-reduction records. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe  **PRECISION CENTER**

**You get more value
for the same dollar—
in the NEW
Bulletin 709
line of starters!**

SIZE 00



This new line of Allen-Bradley motor control will change every idea you have had about starter size, performance, and life. The small size—especially in the higher ratings—is startling. Yet rating for rating the operating life and reliability have been increased many times. Built into each of the seven sizes of this new Allen-Bradley line is an ability to interrupt tremendous currents and to operate year in and year out for many millions of operations without trouble or maintenance.

The new Bulletin 709 starters are just as advanced in appearance as they are in performance. All seven sizes have an aristocratic styling and a distinctive family likeness. Brooks Stevens, famous industrial designer, has given the enclosures such an attractive, modern style that these new starters will prove a distinct sales asset on any machine or installation.

Why not write today for more information on this revolutionary new line of Allen-Bradley Bulletin 709 quality across-the-line motor starters?



SIZE 5

Note the compactness of both the smallest and largest starter in the new Bulletin 709 line. Ratings up to 100 hp, 220 v; 200 hp, 440-550 v.

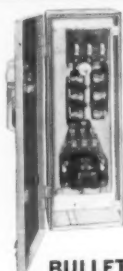
12-61-8M

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

**QUALITY
MOTOR
CONTROL**



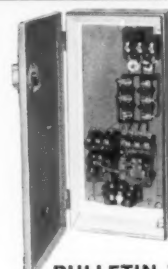
BULLETIN 712
Size 1 combination
starter with fused dis-
connect switch



BULLETIN 713
Size 1 combination
starter with circuit
breaker



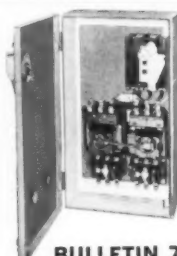
BULLETIN 705
Size 2 across-the-line
reversing starter with
overload relays



BULLETIN 706
Size 1 reversing starter
with fused disconnect
switch



BULLETIN 715
Size 1 across-the-line,
multi-speed starter with
overload relays



BULLETIN 717
Size 2 multi-speed
starter with circuit
breaker



BULLETIN 702
Size 3 three-pole, a-c
solenoid contactor

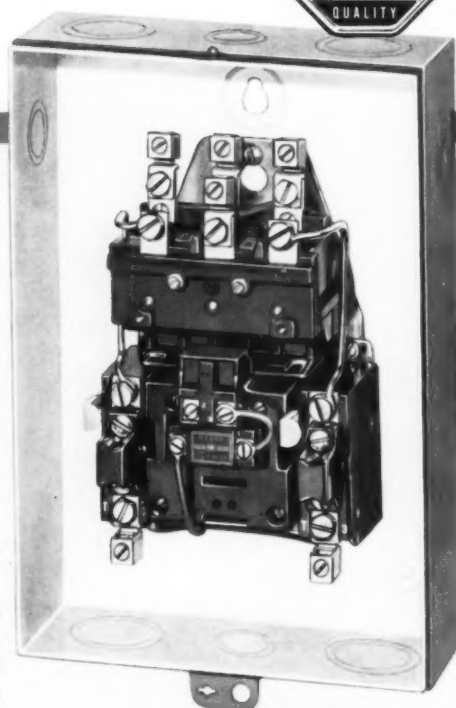


Pygmies in Size Giants in Performance— the NEW Allen-Bradley Across-the-Line Starters!

This new line of across-the-line motor starters is the result of over 30 years of experience and leadership in the motor control field.

While retaining the simple solenoid principle—with only ONE moving part—these starters are completely new in every way. They are amazingly small in size—yet test after test has proved they will not only outperform but also outlast any starter now on the market. They are good for *many millions* of trouble free operations. All have scores of design refinements that make them easier to install and maintain. All are available in the smart new enclosures designed by Brooks Stevens. They make a beautiful addition to any machine or control installation.

You'll want to get the complete story about these truly revolutionary new across-the-line starters. Write for new Publication 6100.



BULLETIN 709

This popular across-the-line solenoid starter shows the new Size 2 construction. Note the white interior and generous wiring space. Bulletin 709 starters are available in the new construction, in seven sizes—Sizes 00 to 5, with a maximum rating of 100 hp, 220 v; 200 hp, 440-550 v.

ALLEN-BRADLEY

Member of NEMA

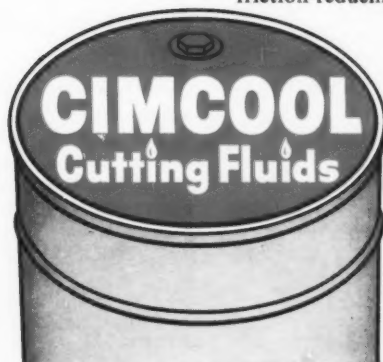
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

**QUALITY
MOTOR
CONTROL**

Announcing A Major "Break-Through" In Cutting Fluid Performance FIVE-STAR ★ ★ ★ ★ ★ CIMCOOL

**From the Research Laboratories
and Production Proving Grounds
of Cincinnati Milling Comes This
Remarkable New Product With
These Proven Advantages:**

- ★ **TROUBLE-FREE.** At lean, low-cost dilutions, Five-Star CIMCOOL goes into your machines and *stays put with no problems!* It lasts a long time and is extremely dependable.
- ★ **NO ODORS.** New bactericides keep Five-Star CIMCOOL in operation *four to six times* as long as other fluids.
- ★ **EXCEPTIONAL RUST PROTECTION.** Two different types of rust inhibitor in this *single-mix* concentrate provide up to 300% more rust control. This rust-control ability permits leaner dilutions, saves you money.
- ★ **CLEAN AND SAFE.** Five-Star CIMCOOL is just as clean as fresh, clear water to work in. It feels, smells and looks good. It will not smoke or catch fire. Good reasons why operators like it.
- ★ **LENGTHENS TOOL LIFE.** Production tests prove this new concentrate is second to none in providing *non-stop production*, because of its exclusive CIMCOOL EP, friction-reducing chemicals.



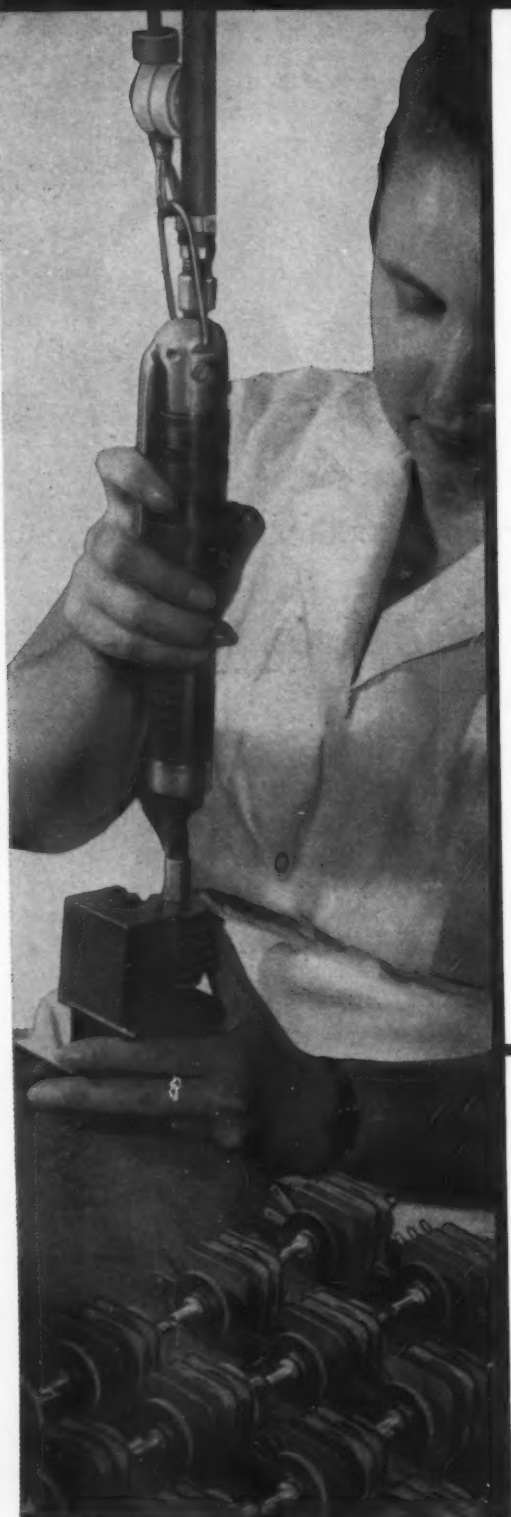
FOR 100% OF ALL METAL CUTTING JOBS
Production-Proved products of The Cincinnati Milling Machine Co.

FIVE-STAR CIMCOOL—Newest in the industry-proven line of CIMCOOL® Cutting Fluids.
CIMPERIAL®—Heavy duty replacement for cutting oils in those low-speed tough jobs.
CIMPLUS—The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, SS)—For every job requiring an oil-base cutting fluid.
ALSO—CIMCOOL Tapping Compound—CIMCOOL Bactericide—CIMCOOL Machine Cleaner.

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

®Trade Marks Reg. U.S. Pat. Off.

INDUSTRY'S MOST PRODUCTIVE LINE



... pioneer in "One-Shot" Torque Control Tools for Threaded Fastener Driving

Chicago Pneumatic has maintained industry leadership in the development of Torque Control Tools since the first "one-shot" screwdriver was announced in 1954.

If you drive threaded fasteners, there's a CP Screwdriver, Nutrunner, Multi-Runner or Impact Wrench to meet your production line problems.

Fast, accurate driving can save you as much as 75% in time . . . hold rejects to a minimum. Shown here are some of the latest CP tools for threaded fastener driving . . . *industry's most productive line*. Let our Torque Control Specialists help solve your fastener driving problems. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*



TORQUE ANALYZER FOR "ONE-SHOT" TOOLS

provides a fast and simple method for testing and calibrating torque control tools. For fasteners as large as $\frac{3}{4}$ ". Maximum capacity: 200 inch-pounds.

OF SCREWDRIVERS AND NUTRUNNERS

NEW DIAL TORK NUTRUNNER

adjustable at the bench to meet a variety of torque specifications on the same job. So accurate it eliminates final tightening with a hand torque wrench. Capacity: #12 to $\frac{3}{16}$ " machine screws. Adjustable from 50 to 180 inch-pounds.



MICROMETER TYPE TORQUE SELECTOR

lets operator "dial-in" the torque he needs for each size of fastener.



"ONE-SHOT" TORQUE CONTROL SCREWDRIVERS

feature the famous CP "one-shot" clutch and silent exhaust. Capacity: #4 to $\frac{1}{4}$ " machine screws. Adjustable from 7 to 100 inch-pounds.



"JOLT-FREE" TORQUE CONTROL ANGLE NUTRUNNERS

Great time-savers for hard-to-reach jobs. Range of torque adjustment: 6 to 70 foot-pounds.



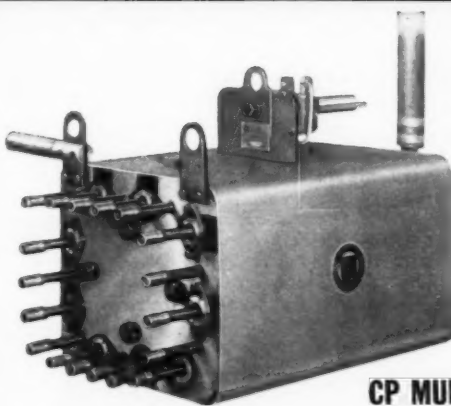
TORQUE CONTROL IMPACT WRENCHES

Recommended where torque limits are critical. Sensing mechanism cuts-off tool air supply the instant specified torque is reached. Capacity to $1\frac{1}{4}$ " bolt size. Range of torque adjustment: 12 to 1000 foot-pounds.



NEW CP-606 IMPACT WRENCH

... a real powerhouse. Gives fast rundowns...loosens frozen nuts or bolts fast. Capacity: $\frac{3}{4}$ " square drive; $\frac{3}{4}$ " bolt size.



CP MULTI-RUNNERS

drive every fastener "just right." Husky motors and "one-shot" clutches insure proper tightness, eliminate work spoilage.



NEW CP-6020 IMPACT WRENCH

Hand-sized, but a man-sized performer, this $\frac{1}{4}$ " bolt size capacity tool packs a fist full of power. 8 models with lever or offset handle. $\frac{3}{8}$ " square drive, or 3 sizes of hex slip chucks: $\frac{1}{4}$ ", $\frac{3}{16}$ " and $\frac{1}{8}$ ".

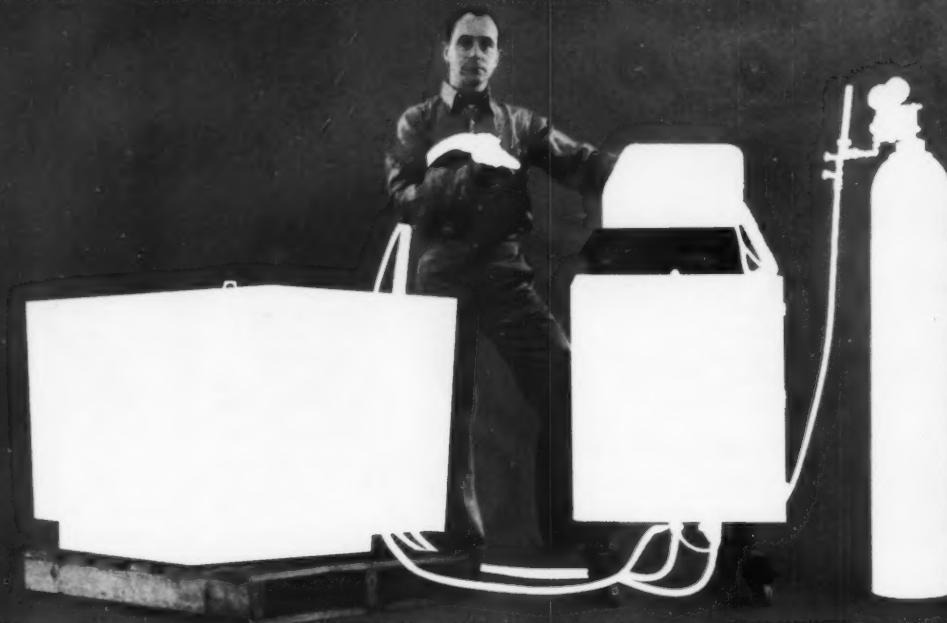


Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

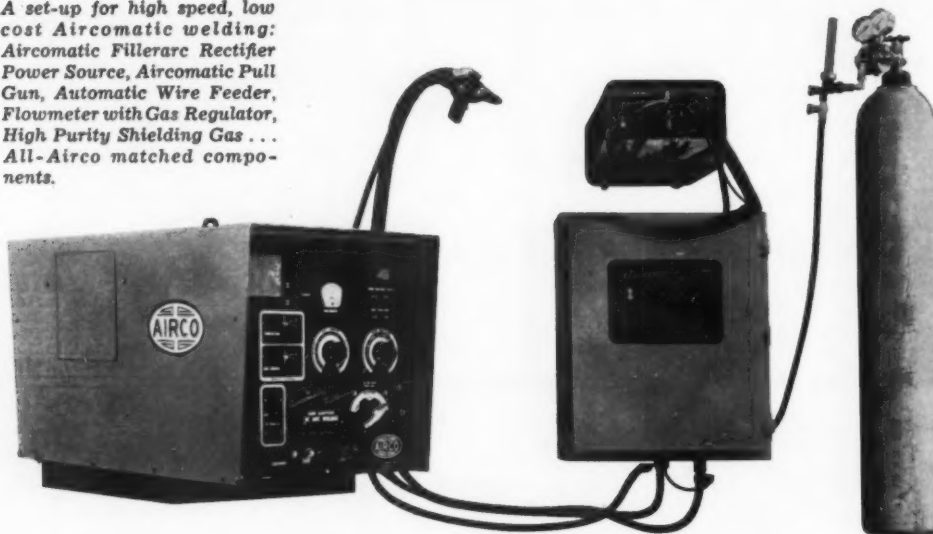
PNEUMATIC TOOLS • ELECTRIC TOOLS • AIR COMPRESSORS • DIESEL ENGINES • HYDRAULIC TOOLS • AVIATION ACCESSORIES

WHEN YOU USE GAS-SHIELDED METAL ARC WELDING



ONLY THE AIRCOMATIC® LINE GIVES YOU EVERYTHING YOU NEED

A set-up for high speed, low cost Aircomatic welding: Aircomatic Fillerarc Rectifier Power Source, Aircomatic Pull Gun, Automatic Wire Feeder, Flowmeter with Gas Regulator, High Purity Shielding Gas . . . All-Airco matched components.



Aiming to weld jet engines? . . . Rock crushers? . . . Whole trains of aluminum gondola cars? . . . Auto body frames? . . . mild steel, stainless, copper alloys or metals of the future?

Do it the Aircomatic way! You can weld it up to 7 times faster, and still turn out top quality welds!

How is this possible? Airco's range of equipment is unequalled anywhere. As a result you get matched components which fit precisely the specialized demands of your job.

Specifics: The Airco Pull Gun handles small diameter wires with the highest precision of all semi-automatics. The Aircomatic Wire Feeder gives you the finest wire feed speed

control. The Aircomatic Fillerarc Rectifier gives you the ultimate in versatility and performance.

For top dollar savings in fabrication here's the No. 1 line in the gas shielded metal arc welding business. Call Airco . . . where the big idea is teamed with unexcelled experience!



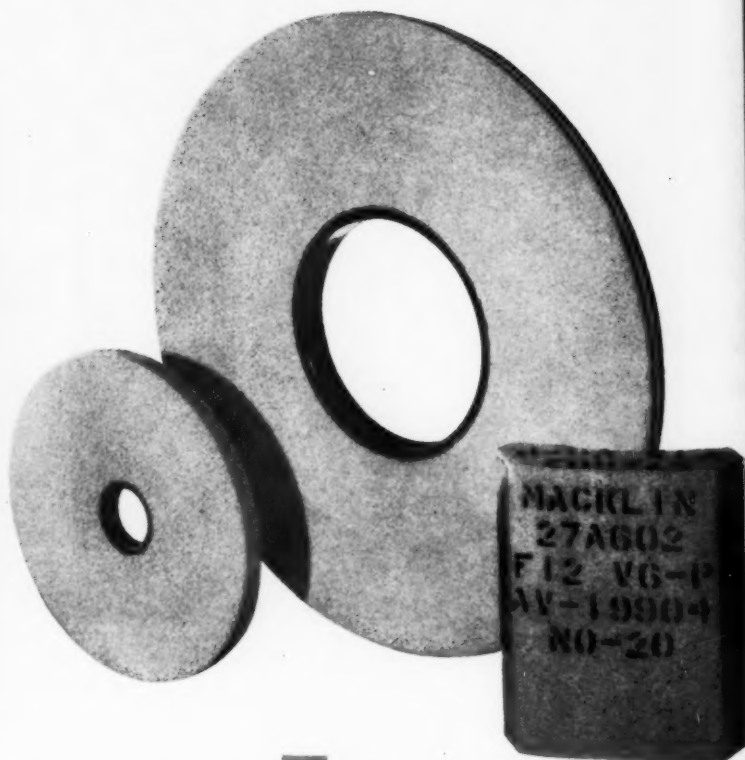
AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated
150 East 42nd Street • New York 17, N. Y.

More than 700 Authorized Airco Distributors Coast to Coast

On the west coast—Air Reduction Pacific Co., Internationally—Airco Co. Int'l., In Canada—Air Reduction Canada Ltd. • All divisions or subsidiaries of Air Reduction Co., Inc.

New Macklin



Gives Premium Results at Regular Price*

"27" Abrasive wheels, the latest product in Macklin's continuing research and development program, is an aluminum oxide abrasive that consistently outperforms premium priced abrasives on many applications. It is ideally suited for a wide variety of operations from surface grinding boiler plate with segments, to precision grinding aircraft parts and very critical crush form work.

"27" is not a mixture of abrasives with diametrically opposite properties. Rather, it is a carefully manufactured abrasive with premium qualities . . . available to you at non-premium cost.

"27" wheels provide rapid stock removal. Can be used for heavy feeds on a wide variety of materials from tool steel to boiler plate.

"27" wheels grind exceptionally well. Provide fast cutting action, and require a minimum of dressing. Form holding qualities are excellent.

Want proof? Then read the actual case histories on the right. Then arrange for a demonstration with your nearest Macklin distributor or call us for the services of a Macklin field engineer.

*in suitable ordering quantities

"Wheels of Profit"

Surface Grind Boiler Plate

20"x4"x8" REC 2/S 27A46 H12 V6-P

"Wheel cut extremely well. Life excellent. Operator liked wheel."

Surface Grind 1010 Mild Steel

20"x5"x16 1/2" CYL 27A46 H12 V6-S

"Wheel produced full load without any scratching."

Regrind Cutting Tools, M-1 and M-2 Steel

24"x2 3/4"x10 1/2" REC 2/S 27A46 L+5 V6

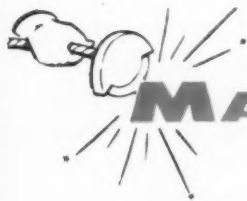
"Wheel life best ever used. More pieces ground per wheel."

Surface Grind Die Cast Machine Parts

6 1/2"x1 1/2"x5" STG SEGMENT

H12 V6-P 27A24

"Wheel very satisfactory. Cut well. Almost doubled life over competitive wheel."

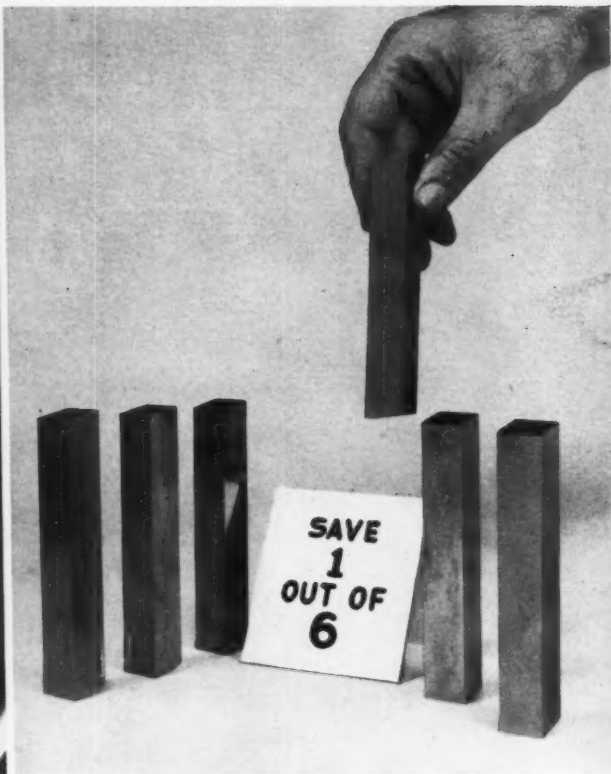


MACKLIN company

Dept. 9 Jackson, Michigan



No discarded cutting oil because of dilution. Cleartex is used for both cutting and lubrication. Works as a hydraulic fluid, too.



Tool life increased as much as 20%. Undiluted Cleartex gives maximum time between regrinds . . . more parts per tool.

END CUTTING OIL

Texaco's "Cleartex Cure" helps cut per-piece production costs by as much as 40 per cent

How the "Cleartex Cure" works — By using Cleartex in both the cutting and lube sumps of your automatics, a "Cleartex Cure" eliminates all losses due to diluted cutting oil. *Cleartex is a triple-purpose oil . . . works equally well for cutting, lubricating and as a hydraulic fluid.*

A Texaco metalworking engineer comes to your plant . . . surveys your automatic set-up . . . tells you which machines can benefit from Cleartex. Since lube oil—and sometimes hydrau-

lic oil—leaks into the cutting oil sumps of most automatics, chances are that the "Cleartex Cure" can substantially cut your per-piece production costs.

Send for free booklet—Our illustrated booklet, "Cleartex in Automatic Screw Machines," gives you full details on how diluted cutting oil may be eating into your profits. To get your copy and an authoritative survey of your automatics, call



Rejects decreased as much as 22%. Cleartex keeps tools sharp and properly lubricated. Finished work is dimensionally accurate.



Production increased as much as 33%. Cleartex minimizes downtime required for tool changes, repair work and adjustments.

DILUTION FOREVER*

the nearest Texaco distributing plant, or check and mail the coupon.

More savings possible — A complete Texaco "Stop Loss" Program may mean even greater savings for your operation. Under the Program, Texaco engineers help select the right lubricant and lubrication interval for every piece of equipment in your plant. They'll also help you set up a workable system of lubrication control.

These two films can improve your profit picture—Texaco has a special color film on the selection and use of cutting oils...and another that dramatizes for management the cost-control possibilities of Organized Lubrication. To arrange for a free showing of either, or both, just check and mail the coupon.

*Field surveys prove lube oil dilutes cutting oil in 7 out of 10 automatic screw machines.

MACHINERY, May, 1961

Tune In: Texaco Huntley-Brinkley Report, Mon. Through Fri.-NBC-TV

TEXACO 
Throughout the United States
Canada • Latin America • West Africa

TEXACO INC., Dept. MA-80
135 East 42nd Street
New York 17, N. Y.

Please send information about:

- ☐ The "Cleartex Cure," including free booklet, "Cleartex in Automatic Screw Machines."
- ☐ Film on selection and use of cutting oils.
- ☐ Film on cost-control possibilities of Organized Lubrication.

Name _____
Company _____
Position _____
Address _____



For more data circle this page number on card at back of book

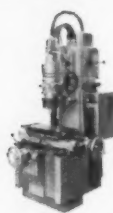
MOORE ANNOUNCES UNPRECEDENTED 10-YEAR GUARANTEE OF MILLIONTHS' ACCURACY

Published Tolerances

Longitudinal Travel:	
Greatest error in any inch	30 millionths
Greatest error in 18 inches	90 millionths
Cross Travel:	
Greatest error in any inch	30 millionths
Greatest error in 11 inches	90 millionths
Squareness:	
Compound slide	60 millionths
Full travel, spindle housing	90 millionths
Full travel, spindle	90 millionths



No. 3 Moore Jig Borer



No. 3 Moore Jig Grinder

10-year Deviation Guarantee

Lead Screws	50 millionths
Quill fit, or clearance (Jig Borer)	20 millionths
Vertical slide fit, or clearance (Jig Grinder)	50 millionths
Compound slide squareness	20 millionths
Base ways	30 millionths
Table ways	30 millionths
Squareness of spindle to plane of travel	50 millionths

Moore can now, with confidence, guarantee the *accuracy-plus-durability* of hardened, ground and lapped lead screws and ways, plus the other locating features of its No. 3 Jig Borers and No. 3 Jig Grinders. Here's why:

The first No. 3 Moore Jig Borer built has now been operating in our toolroom for 5 years, an average of 2,300 hours per year. We have also inspected several other No. 3 machines in customers' plants. Our experience with hardened, ground and lapped lead screws now goes back 30 years. All of this history has provided us with sufficient data to project the performance of our No. 3 machines over a 10-year period.

As a result, we will now *guarantee* that the basic locating features of the standard No. 3 Moore Jig Borer and No. 3 Moore Jig Grinder will not wear or deviate in normal use *beyond published tolerances* over a 10-year period more than the specified amounts shown above.

This guarantee is retroactive to include the No. 3 Moore Jig Borers and Jig Grinders already built and in use. It applies to original owners only, and is in addition to our unqualified 1-year guarantee.

You can call in our service man to check your machine at any time, at our regular charge. If this check reveals wear in excess of that specified above, we will correct the machine promptly at our expense.



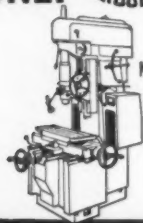
Dick Moore

Richard F. Moore, President
Moore Special Tool Co., Inc.,
734 Union Avenue,
Bridgeport 7, Conn.

April 1, 1961

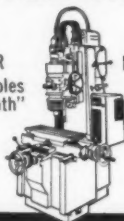
While in New York call Forest 6-3226
(Bridgeport) for visit to our plant

ONLY CAN OFFER THIS COMPLETE PACKAGE OF PRECISION



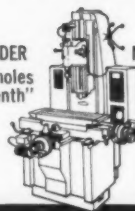
MOORE No. 3 JIG BORER

Locates and bores holes
to less than a "tenth"



MOORE No. 3 JIG GRINDER

Locates and grinds holes
to less than a "tenth"



MOORE UNIVERSAL
MEASURING MACHINE

Measures to
one-third of
a "tenth"



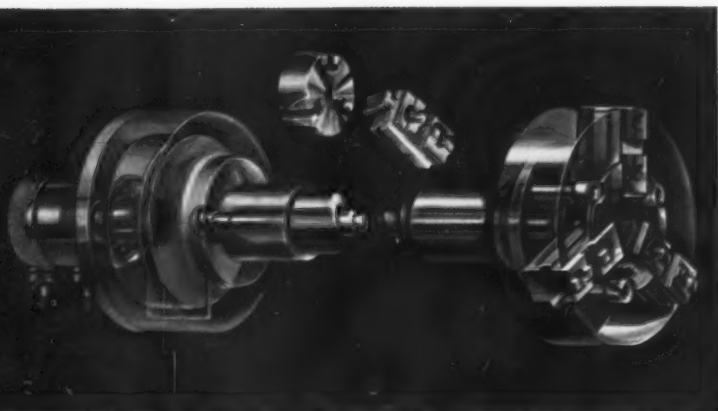
MOORE
ROTARY TABLE

Divides the circle
to less than 2 sec.

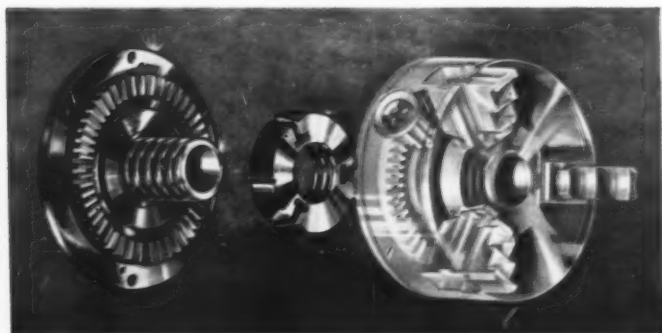
SKINNER PACKAGED POWER CHUCKING ASSEMBLY



Typical major chuck developments that come to you from SKINNER



Packaged power chucking assemblies are available for Atlas, Cintilathe, Hardinge, Logan, Regal, Sheldon, South Bend, and many similar lathes. Assemblies are also available for Brown & Sharpe and similar automatic and hand screw machines to permit chucking of cold drawn parts, small or odd shapes and castings. Packaged assemblies consist of chuck with two or three jaws, threaded drawbar and drawtube, rotating air cylinder, cylinder adaptor and necessary mounting for the individual machine.



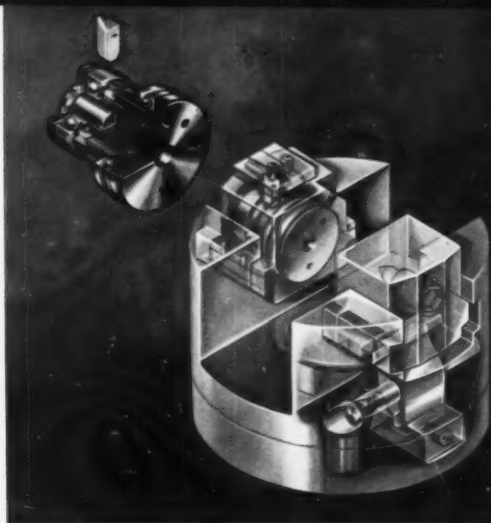
Extra-heavy-duty Wedge-Screw chuck combines best features of power and hand chucks. It develops tremendous gripping power, high accuracy and repeatability by a unique principle. When the lug-type pinion is turned manually or by a power wrench, it engages the gear plate causing the screw to move the wedge. The force of the wedge on the jaws holds the work with tremendous power.

This Wedge-Screw chuck has such useful features as:

- Accuracy—within .001 total indicator reading
- Repeatability—within .0005 total indicator reading
- Complete Range—no size limitation

Many other features including over-tightening and operator protection, sealed operating mechanism, automatic lubrication, etc.

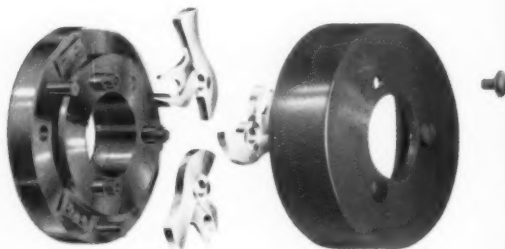
For complete details about packaged power chucking assemblies, indexing chucks, wedge-screw chucks, +GF+ Work Drivers, other chucks and chuck equipment, contact your Skinner Representative or Distributor, or write us at the address below.



Heavy-duty power chuck with jaws that index freely under full pressure. Indexing is simple, easy, and fast. The operator can index manually without touching the work or releasing the pressure. Jaws are indexed by means of a lock screw and slide plate. Note the size and shape of the indexing pin. It fits firmly and positively into the indexing plate so that extreme accuracy of indexing is assured.

One or both jaws can be furnished with indexing mechanisms. As a result, you can index more positions and smaller index angles. There is no need to buy a new chuck for different indexing positions because index jaws or index components can be interchanged quickly and easily.

This new Skinner chuck is available in all body diameters from 12" through 36".



+GF+ Work Drivers distributed by Skinner, are the best clamping devices available for driving rough or smooth blanks between centers. Eccentric jaws with floating spring action hold firm, and any increase in cutting tool pressure and or spindle speed automatically increases the holding power of the work driver. The jaws are easily reversed to accommodate changed direction of spindle rotation.

The protective hood covers all mechanism and provides means of manually opening and closing jaws. A slight turn of the hood, with surface cross-hatched for sure grip, opens jaws and holds them open until work is placed between centers—another turn releases jaws to grip work. **+GF+ Work Drivers** are available to hold work ranging in diameter from $1\frac{1}{2}$ " to $8\frac{1}{2}$ ".

Maximum eccentricity of any piece is $\frac{3}{8}$ ". Finished adaptor plates or rough castings are available for mounting on all types of machines.

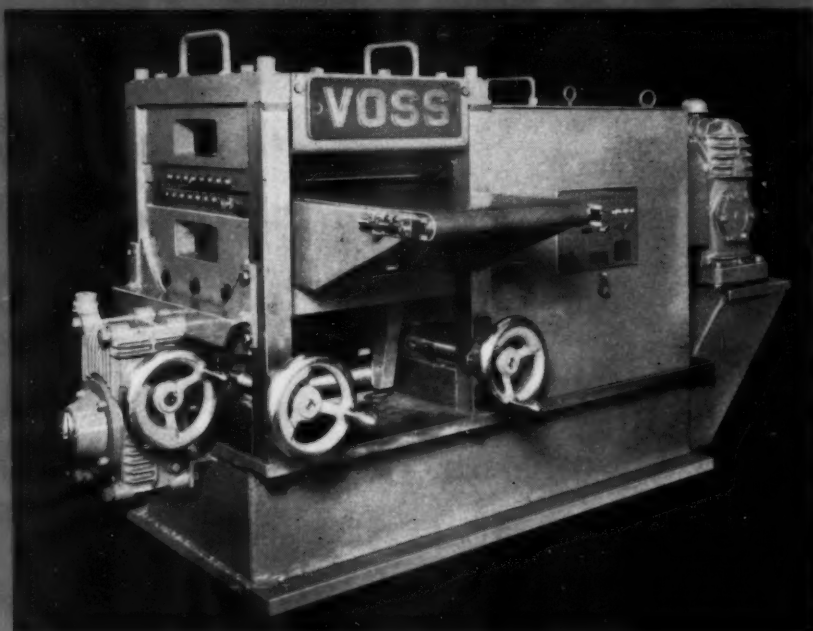


THE CREST OF QUALITY

SKINNERCHUCKS

THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT, U. S. A.

**FLAT!
FAST!**



THAT'S THE STORY OF THE NEW VOSS STAMPED PARTS-FLATTENER

Stamped parts are flattened to .005 of dead flatness *in one pass!* Hand or automatic feed. Heavy duty, low maintenance. Takes no more space than your desk. Can be engineered to flatten parts with irregular surfaces. Savings in time and manpower can be enormous. Low cost for the job it does. If you're looking for cost reduction in your stamped parts operation, call or write Voss Engineering Company.

We'll be glad to arrange a demonstration with your parts, without obligation.



7301 Penn Ave. Pittsburgh 8, Pa. Churchill 2-4422

(Makers of the Voss Precision Roller Leveler)

What does "Blanchard Ground" mean? Well, a glance at this sample case would show that it means finishes as fine as 2 microns. And a quick check with the optical flat below would show flatness to within 1 light band. What's more, Blanchards provide high precision, high production grinding of materials ranging from glass and stone, thru gems and plastics, as well as ferrous and non-ferrous metals. Equally efficient at hogging, too. Send for "The Art of Blanchard Surface Grinding" and get the whole story.

BLANCHARD GROUND

2MU

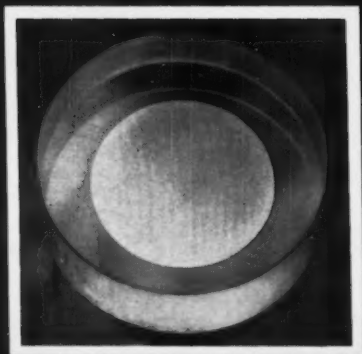
4MU

8MU

15MU

30MU

30MU



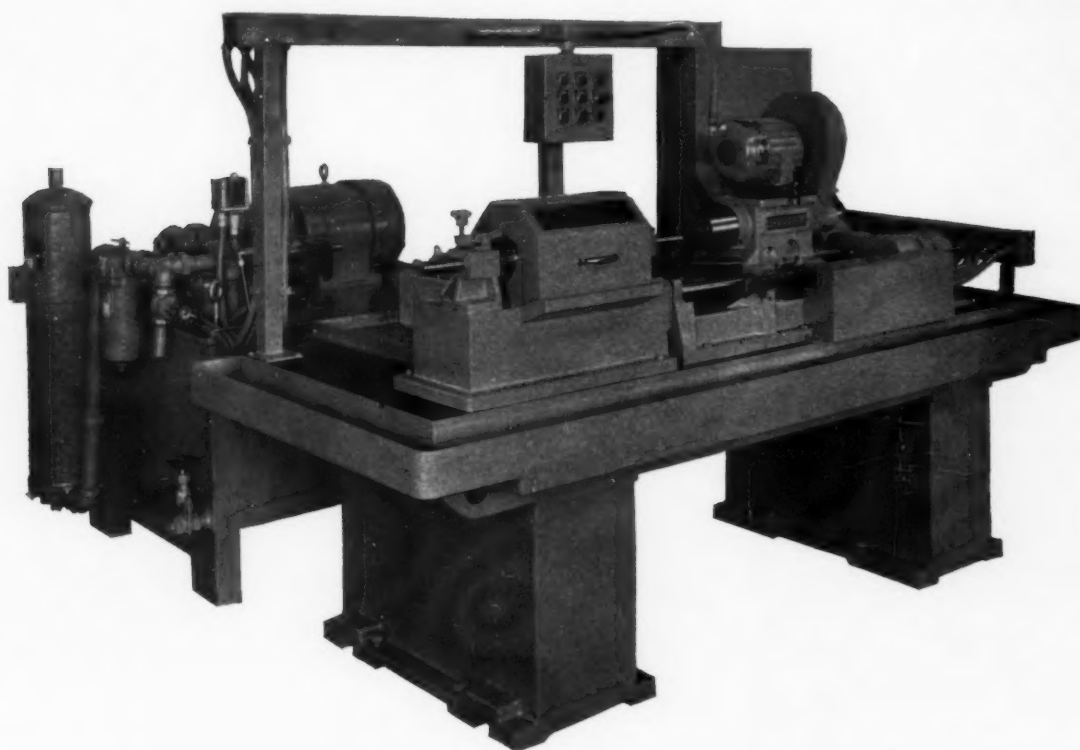
PUT IT ON THE **BLANCHARD**

THE BLANCHARD MACHINE COMPANY 64 State Street, Cambridge 39, Massachusetts

NEW LELAND-GIFFORD HORIZONTAL GUN DRILL

WITH

- *Lead screw or hydraulic feed drilling unit*
- *Base to suit requirements*
- *High pressure coolant system*



Designed to deliver both performance and production, this new Leland-Gifford Horizontal Gun Drill is completely adaptable to your deep hole drilling needs.

Available with hydraulic or lead screw feed to suit your range of hole depths up to $\frac{3}{4}$ " diameter. Can be furnished with traverse up to 48 inches.

An ideal machine for your job can be developed . . . on a standard or custom base, with or without tooling, with or without high pressure coolant systems.

Leland-Gifford's long-established reputation, broad range of experience and complete line of drilling machines is your assurance of the most successful solutions to your drilling problems.

*Write for complete information — or ask
to have an experienced sales engineer call.*



LELAND-GIFFORD

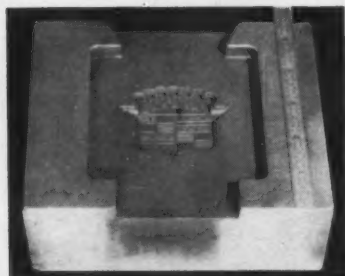
WORCESTER 1, MASSACHUSETTS

DRILLING MACHINES

PROFIT

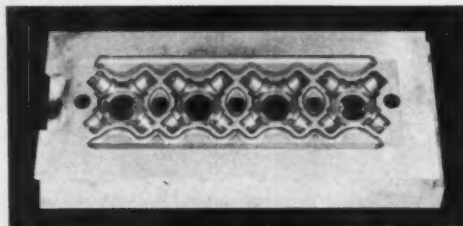
SQUEEZE?

If you make or use dies ELOX[®] will put you in
the **EDM PLUS PROFIT PICTURE**



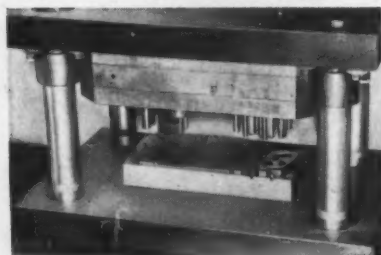
it's a
FaCT

Elox EDM machined this emblem die in just 5½ hours . . . with only 2 hours of preparation required and ½ hour of polishing after Eloxing. Conventionally it takes 40 hours . . . and tests have proven that the Elox produced die has ten times the standard die life due to cutting the detail in a homogeneous hardened tool steel.



it's a FaCT

6¼ hours was all that was needed to EDM this Universal Joint Die . . . removing 8 cubic inches of metal. Here again, no hand finishing required.



it's a
FaCT

29 Punches with 14 different shapes, Eloxed their own mating die openings with perfect alignment and die clearance. This superior compound die for a phenolic printed circuit panel was made at 50% of conventional machining costs.

it's a FaCT

Your future profits will depend on your full understanding and considered application of this new, significant and proven technique in the science of machining. Elox is the acknowledged world leader in electrical discharge machining. Put our knowledge and experience to practical use in your field . . . cutting costs, reducing down time, improving your product.

Keep your profits *up* with up-to-date "know how" on ELOX EDM.

Many of your competitors are.

ELOX *corporation of michigan*

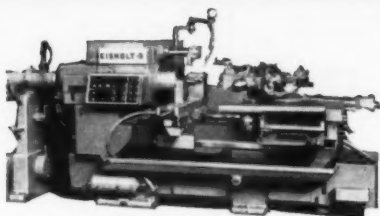
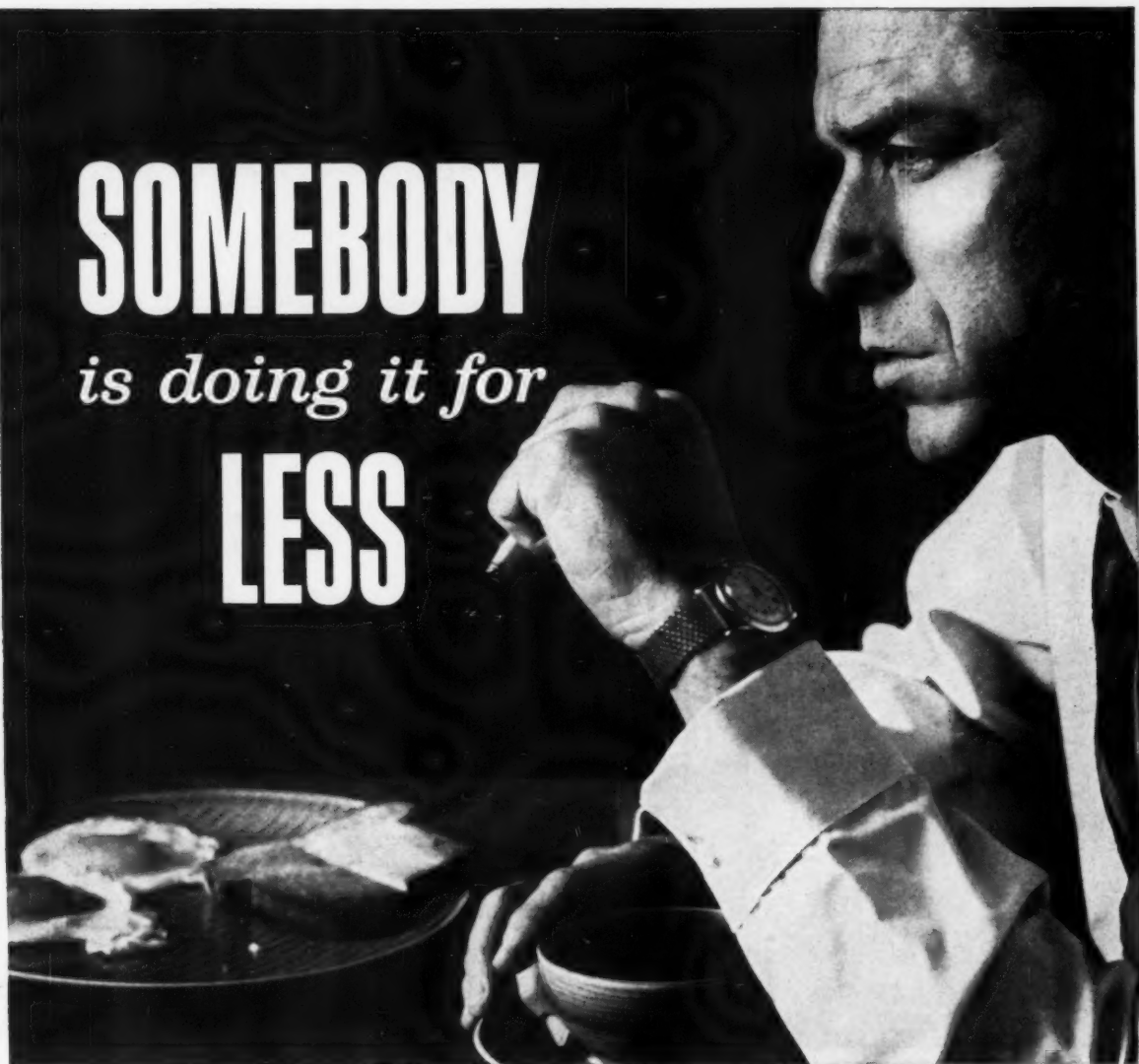
1831 Stephenson Highway • Troy, Michigan • MU 9-1921

Represented throughout
the world by Elox
trained personnel.

SOMEBODY

is doing it for

LESS



GISHOLT MASTERLINE AR TURRET LATHE Converts for bar or chucking work in less than one hour. Sets up like a turret lathe, from the front—no gears to change—uses same standard tools. Cycle setting is learned in less than a day. Compare these extras: greater capacity at lower original cost than any comparable automatic; automatic withdrawal for chip clearing in deep holes; internal threading with solid taps requiring spindle reverse; external threading with self-opening die heads and automatic re-cocking; reverse feed and individually adjustable dwell to all tool stations; 16 spindle speeds and infinite feeds—none lost when threading. Optional: 8-sided turret; overhead cut-off slide or swinging stock stop; automatic recessing slide tools; JETracer® with turret slide tools.

Ask your Gisholt Representative for a desk-side demonstration, or write for Catalog 1224.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers® • Threading Lathes • Factory-Rebuilt Machines with New-Machine Guarantee

With recent developments in automatic machining, many manufacturers—maybe your toughest competitors—are cutting costs substantially.

Even small runs are going automatic—both bar and chucking work too! All this with the Gisholt AR® Turret Lathe at little more than the cost of a hand-operated turret lathe.

This is no exaggeration: the Gisholt AR can cut your *direct* machining costs by 25% to 40% on work now handled on manual lathes—can give you *indirect* savings in tooling, inventory, setup, inspection, materials handling and floor space. Investigate AR—your best answer to the cost-profit squeeze.



GISHOLT

MACHINE COMPANY
Madison 10, Wisconsin, U. S. A.



Why Kearney & Trecker chose 8-channel punched paper tape input

The Kearney & Trecker Milwaukee-Matic is a remarkable tool even without numerical control. With NC, it's close to revolutionary. This automatic multi-machining center permits fast, economical small-lot manufacturing with minimum planning, far less lead time and dramatic reductions in tooling and inventory costs.

One major key to Milwaukee-Matic efficiency is the input. Kearney & Trecker picked 8-channel punched tape for reliability, durability, accuracy. And one thing more: ease of preparation on the Friden Flexowriter®. The Flexowriter has a standard typewriter keyboard. The operator (any competent typist) prepares a *visual* proof as she makes the tape. The machine parity-checks each code automatically. And finished tapes can be double-checked (or quickly duplicated) by running them back through the Flexowriter's reader.

Along with Kearney & Trecker, the great majority of machine tool manufacturers have already standardized

on 8-channel punched tape input. Take it from them: punched tape is the best NC input. And in punched tape, Friden is the leader.

THIS IS PRACTIMATION: Friden is the world leader in tape technology and the practical application of the automation it makes possible. For full information, call your local Friden Systems Representative. Or write: Friden, Inc., San Leandro, California. © 1961 FRIDEN, INC.

Frident

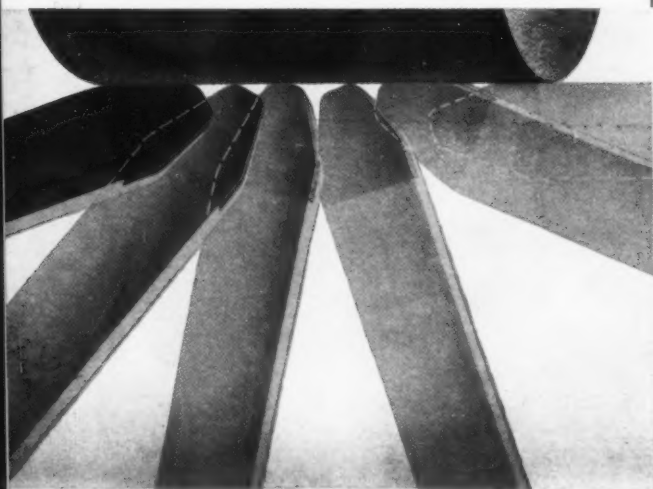
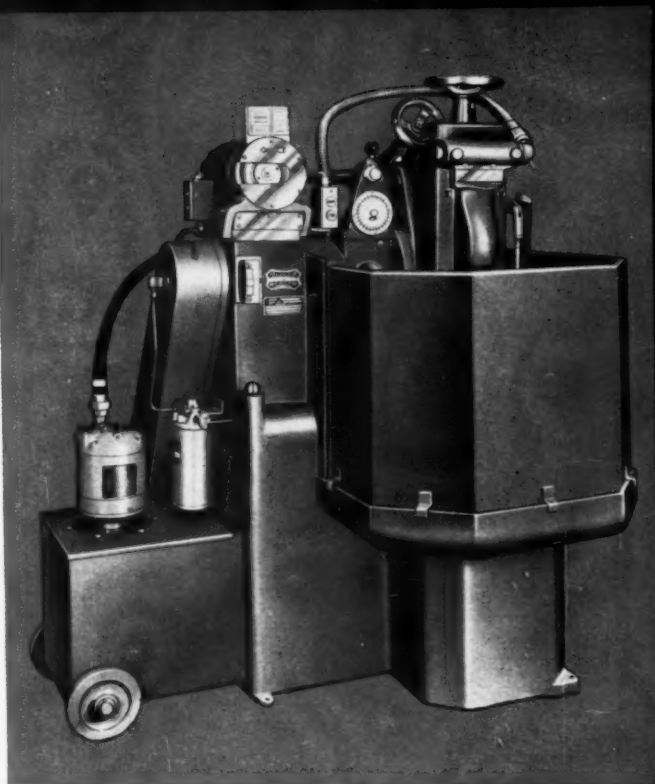
Sales, Service and Instruction Throughout the U. S. and World

NOW FOR 1961

OLIVER OF ADRIAN TEMPLATE TOOL BIT GRINDER

Fast! Simple! Accurate! These features highlight the Oliver Template Tool Bit Grinder for 1961. This precision machine sharpens single point tungsten carbide, high speed and stellite turning tools in one simple, efficient grinding operation. All original flats and radii are duplicated exactly every time the tool is ground.

You get four added dividends when this Oliver grinder takes its place in your tool room. These include rapid sharpening, positive duplication, grinding wheel economy and high salvage value. What's more you will be protecting your initial investment in tool bits.



Duplicates precisely in one operation

"Template control" takes the guesswork out of grinding and assures precise duplication of the original tool bit geometry. Original flats and radii remain the same, from the first through the last grinding.

The template at the top of the specially designed tool holder is a twice-size replica of the tool form being ground. The tool, securely held at mid-point in the holder, contacts the wheel and is ground until the template touches the template stop. The tool is ground to the *exact* profile of the template. The entire precision operation takes only seconds!

Salvages tool bits at low cost

It is common practice to discard tool bits when a portion of the carbide is broken out for a considerable distance. The Oliver Tool Bit Grinder permits the removal of $\frac{1}{8}$ " to $\frac{1}{4}$ " of carbide in a minute or two. You get new tool performance at a low cost. Look for other features, too.

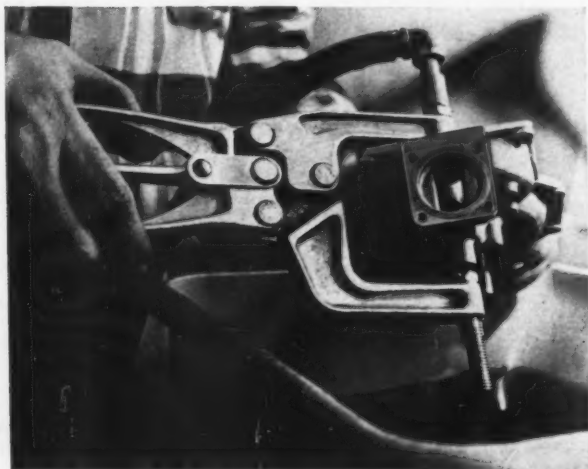
- The total time involved in sharpening a tungsten carbide tipped tool bit is negligible. An average $\frac{3}{4}$ " square tool requiring total stock removal of about $\frac{1}{32}$ " is sharpened completely in about 30 seconds. This includes all angles, radii, and soft steel support.
- Grinding wheel economy is outstanding. Most users find secondary diamond wheel finishing of carbide tipped tools completely unnecessary. The 20" diameter silicon carbide wheel produces a micro-finish almost equal to that ground with a diamond wheel.

Prove to yourself the speed, accuracy and versatility of the Oliver Template Tool Bit Grinder. We will grind your tools on a "no charge" basis. May we send you a quotation?

OLIVER of ADRIAN
1410 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS—AUTOMATIC AND MANUAL
FACE MILL GRINDERS—TOOL AND CUTTER GRINDERS—TOOL
BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES.

Look what clamps are doing!

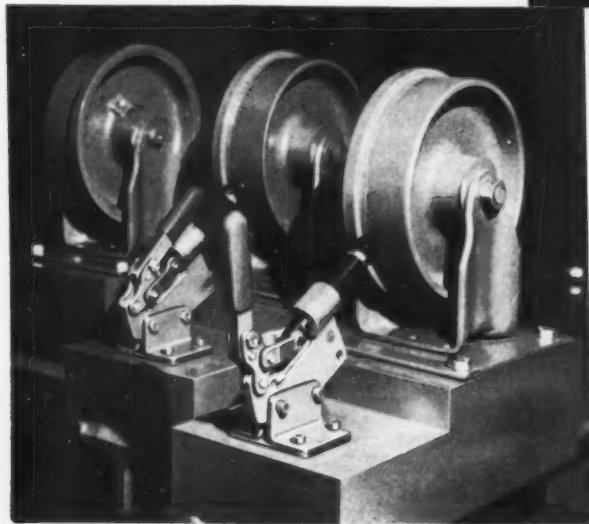
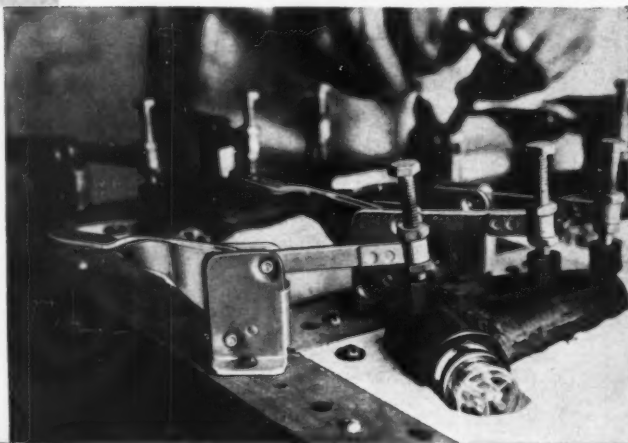


*Practical uses of Wespo
Toggle Clamps and Pliers that
may suggest ways you can save*

Toggle plier serves as low cost fixture for testing castings
The air line is connected through one jaw of a Wespo Model 522 Toggle Plier. The plier is then clamped onto the casting and air applied by a foot control. Immersing the casting into a tank quickly spots any defects. Patented "Quick trigger" feature of the Model 522 instantly releases the casting; speeds testing. Rugged, lightweight Wespo toggle pliers are available in various jaw capacities and sizes.

Holding these glued parts together while drying is a simple task with Wespo Horizontal Bar-Type Toggle Clamps. Neoprene-capped spindles prevent damage to plastic surfaces, yet securely hold the parts during the drying operations. Wespo toggle clamps are available in more than 80 types and sizes. So, the next time you think clamps, think Wespo!

Simple, low cost "parking brake" for this track-operated frame is provided by a Wespo Push-Pull Clamp equipped with a neoprene-capped spindle. "Brake" is quickly applied or released by a simple flick of the wrist. Wespo Push-Pull Clamps are available in various sizes and holding pressures and are ordinarily used on holding fixtures where push or pull clamping is required.



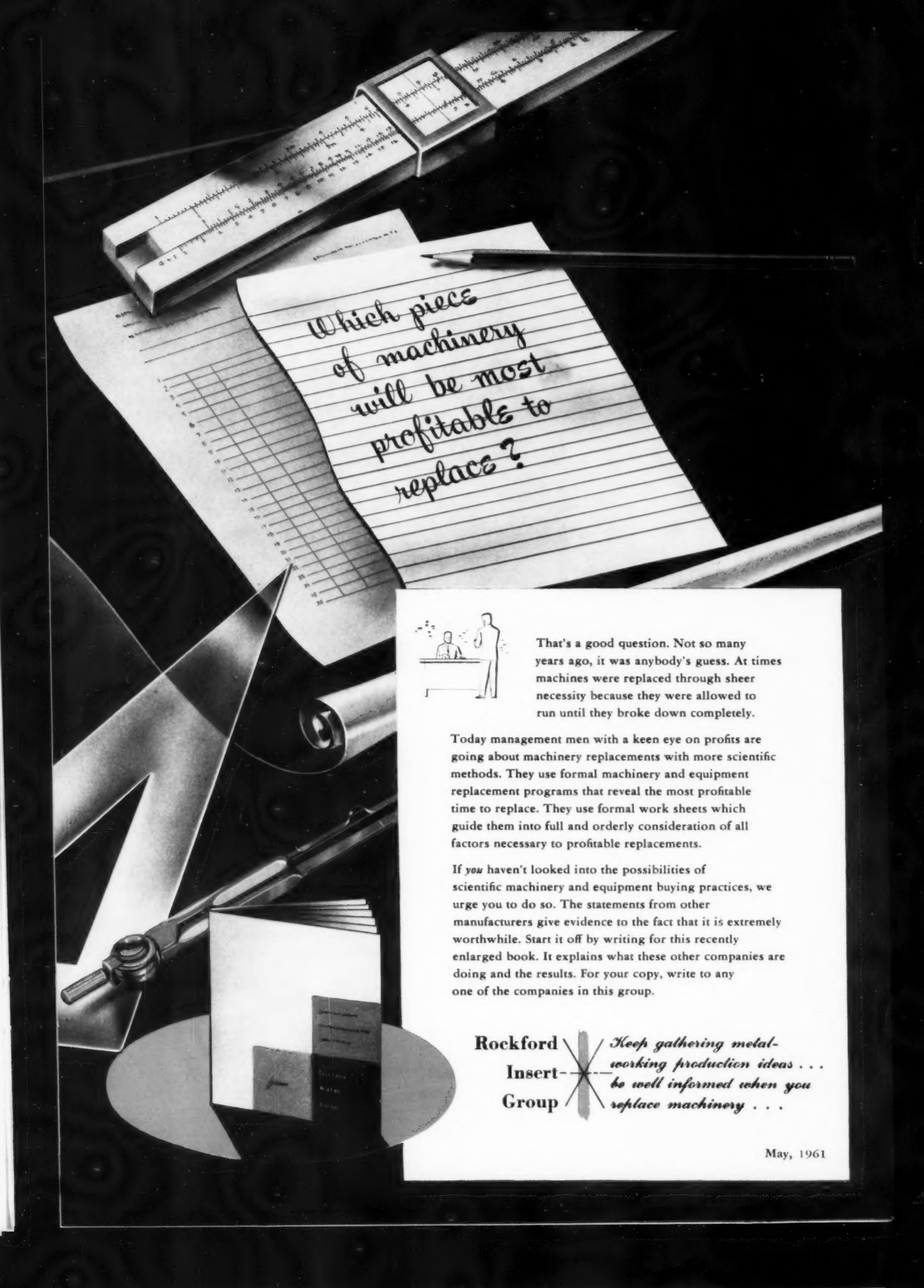
FREE CLAMP CATALOG!

*Ask your Wespo distributor
for your free copy of this
16-page Wespo catalog. It
will help you quickly select
the right clamp for every
clamping job.*



WESPO

DIVISION OF VLIER ENGINEERING CORPORATION
26935 W. Seven Mile Rd., Detroit 19, Michigan
Formerly West Point Manufacturing Company



Which piece
of machinery
will be most
profitable to
replace?



That's a good question. Not so many years ago, it was anybody's guess. At times machines were replaced through sheer necessity because they were allowed to run until they broke down completely.

Today management men with a keen eye on profits are going about machinery replacements with more scientific methods. They use formal machinery and equipment replacement programs that reveal the most profitable time to replace. They use formal work sheets which guide them into full and orderly consideration of all factors necessary to profitable replacements.

If *you* haven't looked into the possibilities of scientific machinery and equipment buying practices, we urge you to do so. The statements from other manufacturers give evidence to the fact that it is extremely worthwhile. Start it off by writing for this recently enlarged book. It explains what these other companies are doing and the results. For your copy, write to any one of the companies in this group.

Rockford

Insert

Group

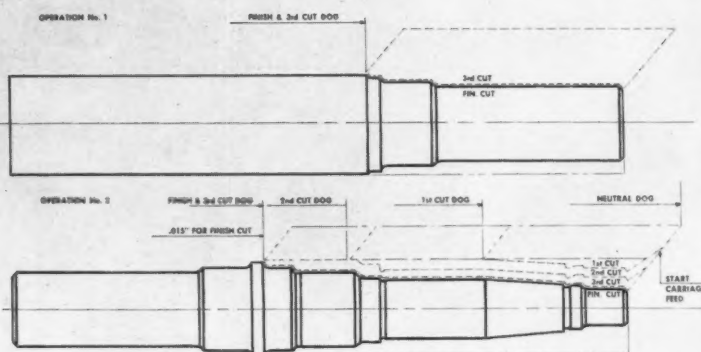
*Keep gathering metal-
working production ideas . . .
be well informed when you
replace machinery . . .*

May, 1961

See how quickly you can set up this Sundstrand Multi-Cut Lathe for an Automatic Cycle



only 20
minutes for
complete setup
for this part



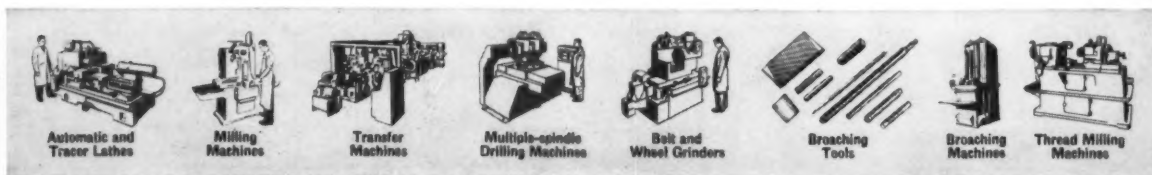
Fully automatic single-point tracer turning of short as well as long runs is practical and profitable with a Sundstrand Model 14T multi-cycle lathe. No machine of its class can be set up faster. You spend maximum time machining, minimum time getting ready.

The example given on these pages is typical of the ease and speed of *complete* setup. Everything that you need to do to get ready to machine a part is described here.

A single template, easily attached at the

front of the machine and above the work, guides the tool for all ruff, semi-finish, and finish operations. No matching of cuts is required. The template stays in fixed position, does not have to be indexed for multiple cuts. Zero reference points for template, stroke and depth of cut settings reduce time for recorded or programmed set-ups.

For high production, low cost and precision accuracy, here is a machine you will want to evaluate. Complete details on request.

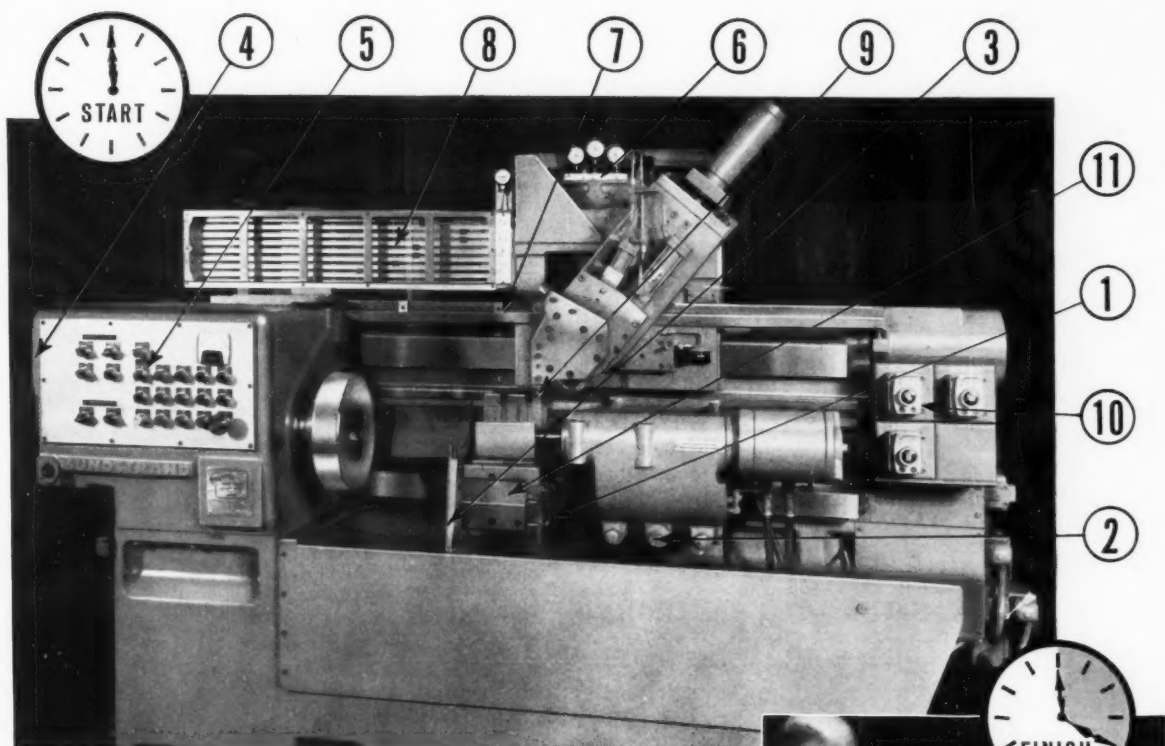


May, 1961

For more data circle No. 800 on card at back of book.

CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.



SETUP FOR OPERATION NO. 1

1. Position Facing Slide
2. Position Tailstock
3. Set Work Rest
4. Change Pick Off Gears
5. { Position Carriage
Set Selector Switch (Rough & Fin.)
Set Selector Switch (1 Ruff)
Set Selector Switch (High Speed Fin.)
7. Mount Template
8. { Set Dog Finish Cut
Set Dog 3rd Cut
Set Neutral Dog
9. Index Tool Point
10. Set Carriage and Facing Slide Feed Rate

SETUP TIME FOR
OPERATION NO. 1 — 14 MINUTES

SETUP FOR OPERATION NO. 2

5. { Set Selector — 3 Cuts
Set Selector Facing Slide
Set Selector Facing Slide 3rd Cut
6. { Set Dial 1st Cut
Set Dial 2nd Cut
7. Mount Template
8. { Set Dog 1st Cut
Set Dog 2nd Cut
Set Dog 3rd Cut
Set Dog Finish Cut
9. Index Tool Point
11. Set Facing Tool

SETUP TIME FOR
OPERATION NO. 2 — 6 MINUTES

COMPLETE SETUP TIME—20 MINUTES



READY TO MACHINE!

OTHER COST-REDUCING BENEFITS OF SUNDSTRAND LATHES

- Adequate horsepower for maximum utilization of carbide or ceramic tools.
- Standard tools, insert or brazed-type, can be used throughout—no tooling inventory required for small-lot runs.
- Uniform stock removal for subsequent grinding or finishing operations
- Ruff and finish automatic cycle often makes possible elimination of green grinding.
- Rack adjustment for tailstock and facing carriage—scales simplify positioning of tailstock, facing slide, template, and control dogs.

- Easy front loading. Automatic loading and unloading can be readily applied.
- Infinitely variable feed.

SEND TODAY for Bulletin No. 627 which gives complete information and specifications on Sundstrand 25 or 40-hp Model 14T multi-cycle hydraulic tracer lathes for lower cost machining of short- and long-run work.



SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • Division of Sundstrand Corporation

For more data circle No. 800 on card at back of book.

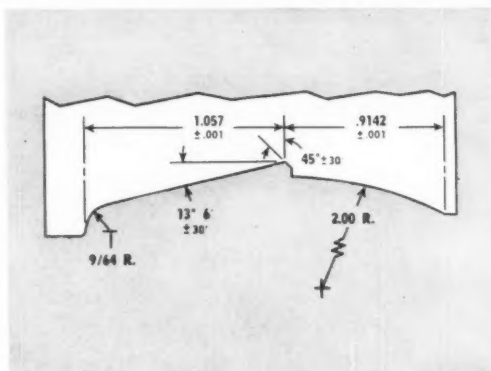
May, 1961

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

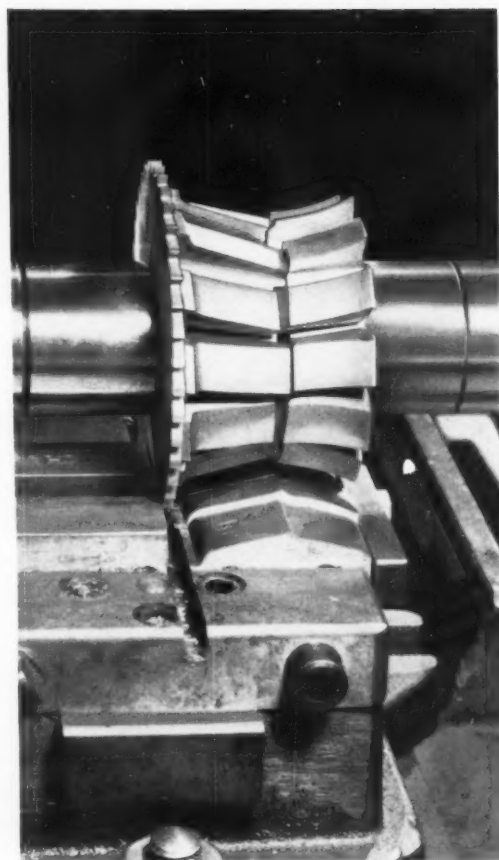


COMBINE

How many FREE OPERATIONS can you see in the set-up illustrated below? Not a fair question, but there are TWO. With the help of Barber-Colman cutter engineering, the customer was able to combine complex and very accurate milling in a single, economical operation.* There may be possibilities for savings like this in your plant. Perhaps special form cutters can be designed for SINGLE-SETUP MACHINING of parts you may now be shaping, crush grinding, or milling. A Barber-Colman cutter engineer can help you develop these opportunities. He is a fully qualified tool designer. He won't waste your time. Even more important, engineering and manufacturing facilities backing him up cannot be duplicated anywhere. For example, an electronic computer is used to establish correct tool geometry. This means you get more actual development man-hours per job. The right combination



OPE



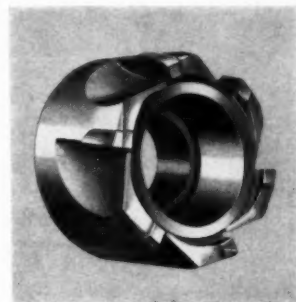
May, 1961

For more data circle No. 801 on card at back of book.

CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.

of flute helix, clearance angles, diameter, and number of teeth are determined scientifically — not by trial and error./The quality and depth of engineering talent available to you as a Barber-Colman customer can be worth many times the cost of tools. Early consultation on new parts can add to your engineering capacity. You get the benefit of proprietary innovations in metalcutting . . . in high-speed steel and carbide metallurgy, in tool design, and in manufacturing methods. Ask your Barber-Colman representative about this valuable free service.



RATIONS

*Two opposed surfaces on the part shown (left) require machining at right angles to the cutter axis. For efficient milling at those points, teeth must have both left-hand and right-hand axial relief. The problem was solved by making the tool interlocking, with axial relief in both directions. Opposed helical flutes assure smooth cutting and excellent surface finish. A free cutoff operation was gained by ganging a metal-slitting saw with the form cutters. Cutters are unground. Yet, all dimensions are held to a maximum tolerance of $\pm .002$ in. Angular surfaces are held to ± 30 minutes.



BARBER-COLMAN COMPANY

52 LOOMIS STREET, ROCKFORD, ILLINOIS

For more data circle No. 801 on card at back of book.

May, 1961

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



Metalworking Trend: closer tolerances, finer finishes, and faster production.

New Machines: Mattison's horizontal-spindle precision surface grinders... with improved finish capabilities, new automatic controls to speed work and control quality, table lengths from 36" to 192".

How to Save: Electronically controlled cross-feeds within $\pm 1/4$ " of either edge without work stoppage. Automatic wheel reset after dressing. Quiet, smooth, cool hydraulics. Box-type column rigidity. Power assist table positioning. Optional automatic downfeed.

Contact your Mattison dealer for details.

MATTISON MACHINE WORKS
Rockford, Illinois



**Greater
accuracy,
finer
finish...
consistently,
more
automatically!**



May, 1961

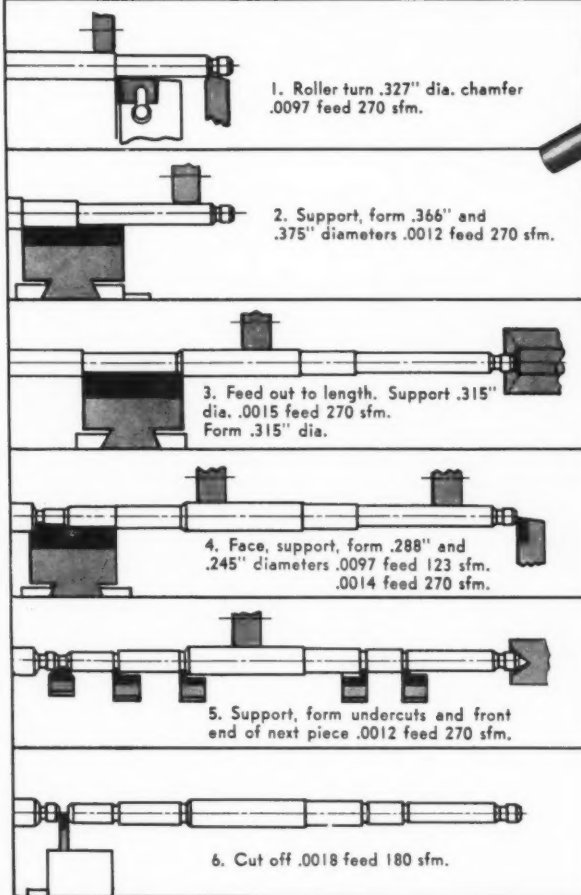
For more data circle No. 802 on card at back of book.

MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.

GREENLEE AIR-FEED AUTOMATICS BENEFIT "ELECTROLUX" FOUR WAYS . . .

MACHINE . . . 1"-6 Automatic Bar Machine
Air-Feed — Feedout on index and in 3rd position during machine cycle.
TOOLING . . . Carbide Tipped
MATERIAL . . . 1137
STOCK SIZE . . . 13/32" rd.

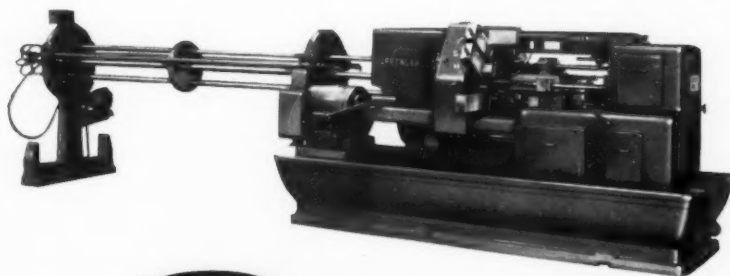
TOOL SLIDE STROKE . . . 1-9/16" at .0097" feed.
SPINDLE SPEED . . . 2540 rpm 270 sfm.
MACHINE TIME . . . 5.8 seconds.
ESTIMATED GROSS PRODUCTION . . . 620 per hour



- 1 Eliminate stock pushers . . .
- 2 Eliminate scoring of stock . . .
- 3 Reduce downtime during set-up . . .
- 4 Provide extra length feed-out . . .

The part is a 6-7/8" long armature shaft used in the "Electrolux" vacuum cleaner. It demonstrates how effectively Greenlee Air-Feed Automatics and carbide tooling can team-up to increase production and reduce costs. The shaft is machined from 13/32" S.A.E. 1137 steel at a gross production rate of 620 pieces per hour. Recommended cutting speed for high speed tooling is 120 sfm. The rate was boosted to 270 sfm with carbide-tipped tooling. Sequence of operations is shown at the left.

Note how the stock is partially fed out on the index and to its full length in the third position. This provides for the most effective tooling arrangement. Greenlee Air-Feed Automatics permit greater job versatility and assure added profits. See your Greenlee representative or send us a print of your high-cost problem-part.



PRODUCTION MACHINERY
GREENLEE BROS. & CO.

SINCE 1863

1975 MASON AVENUE
ROCKFORD, ILLINOIS

COMMERCIAL CASTINGS

TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS • DIE CASTING MACHINES • TRIM PRESSES • HYDRAULIC AND HAND TOOLS



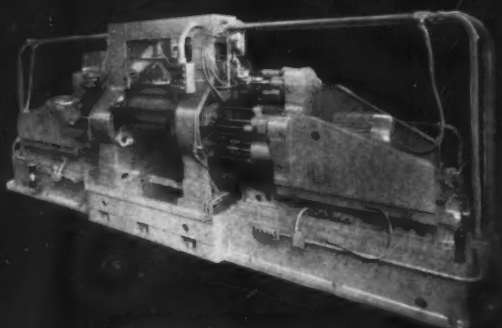
Write for
your copy of
Catalog A-405

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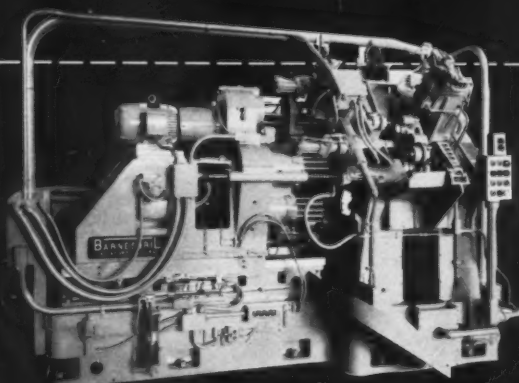
May, 1961

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

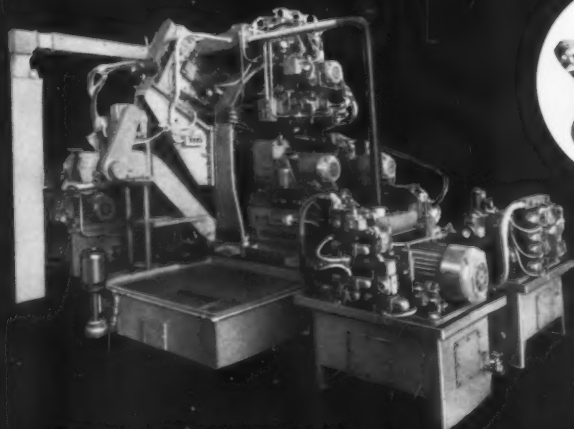




Barnesdril 8-Station Double-End Trunnion-Type Machine drills, reams, chamfers, and probes rear axle shafts at the rate of 200 pieces per hour at 80%.



Special 8-Station Drum-Type Machine designed and built by Barnes Drill Co. for drilling, reaming, chamfering, tapping, and probing rear axle drive gears at 200 parts per hour at 80%.



Barnesdril 6-Station Trunnion-Type Machine performs drilling, threading spindle end, reaming, milling keyway, spot-facing, and probe operations on automotive steering knuckles at 208 pieces per hour at 80%.

AGAIN...and AGAIN...and AGAIN BARNESDRIL ENGINEERS MEET THE CHALLENGE...

...TO SPEED PRODUCTION OF REAR AXLE SHAFTS

Barnesdril's design improvement program led to the development of this 8-Station Trunnion-Type Machine. It produces as many rear axle shafts in one 8-hour shift as an older style Rotary Index Machine did in five 8-hour shifts.

...TO CUT COSTS ON REAR AXLE RING GEARS

This Drum-Type machine is a recent Barnesdril engineering achievement to substantially increase production of ring gears for a large automobile company. Equally as important as increased production speed is the extreme tolerance accuracy and precision machining incorporated in this unit.

...TO IMPROVE OUTPUT ON STEERING KNUCKLES

Another Barnesdril Trunnion-Type Machine — a 6-Station Unit for machining steering knuckles. Application of a horizontal-type machine achieved more effective chip disposal, increased power through heavier construction, and higher speeds and feeds.

Barnesdril's experience in designing and building special machinery is at your disposal.

Honing Machines/Production Units
Filtration Units/Drilling Machines

BARNESDRIL



PRODUCTION UNITS

BARNES DRILL CO.

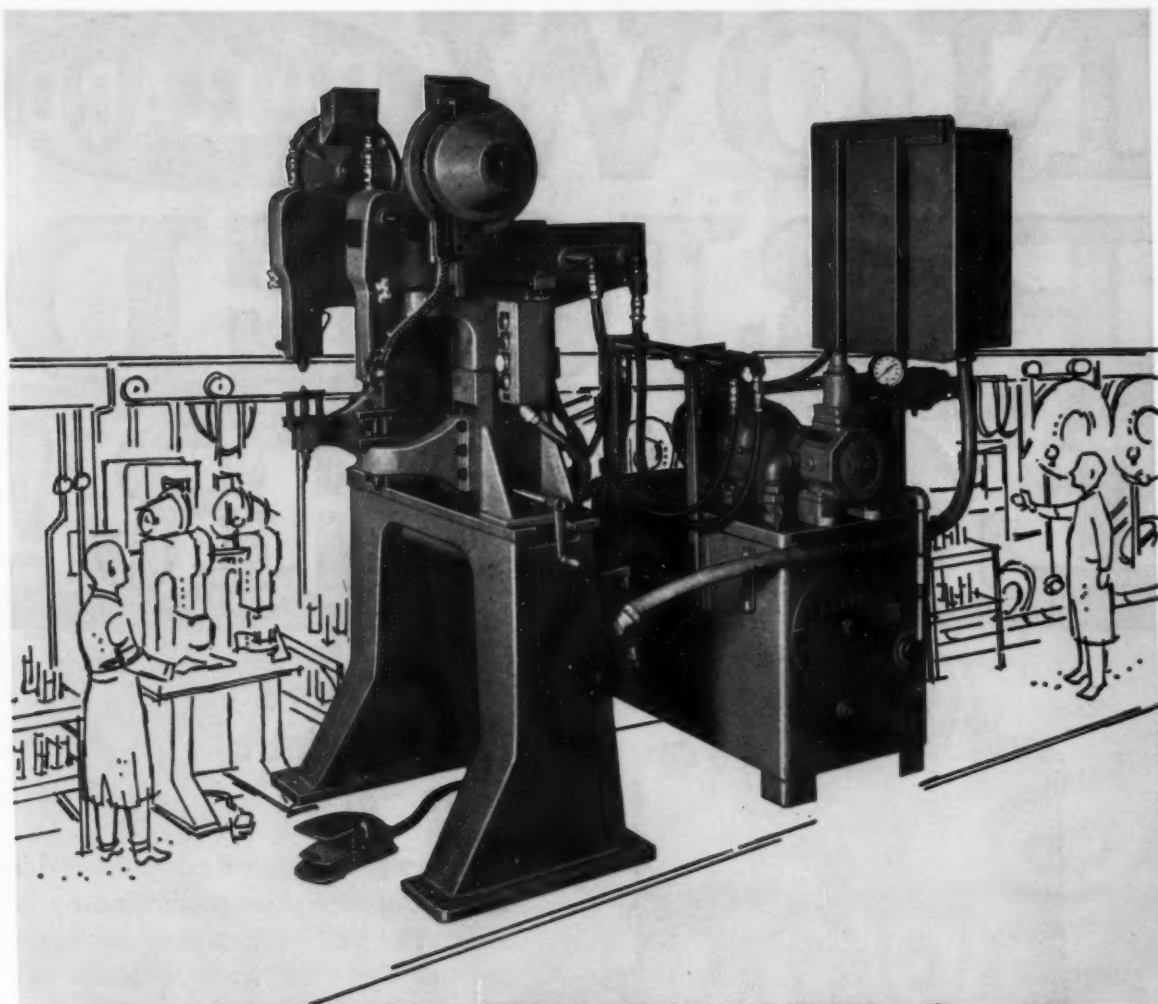
820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE • 13121 PURITAN AVENUE



May, 1961

For more data circle No. 804 on card at back of book.

MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.



A T-J RIVITOR

on your production line
means higher production rate . . . lower unit cost!

T-J Rivitors and Clinchers are designed, engineered and manufactured to conform and operate efficiently on today's high-speed production lines. For whatever your product . . . if it demands a fastening assembly procedure . . . a T-J riveting or clinching machine adds to its high quality standards by their ability

in providing long, rugged service-free life.

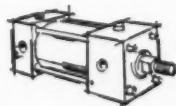
Many standard designs to choose from . . . or a T-J can be custom designed for your exact requirements. Write Tomkins-Johnson, 2425 W. Michigan Ave., Jackson, Mich., today. Ask for Rivitor and Clinchor Bulletin No. 646 or Clinchor Bulletin No. 555.



RIVITORS



CLINCHORS



CYLINDERS



CUTTING TOOLS



TOMKINS-JOHNSON

JACKSON, MICHIGAN

NOW **BULLARD** PRICED LOWER!



NEW Bullard Mult-Au-Matic Type "M"

Contrary to the general upward trend in the cost of new plant production equipment, The Bullard Company is offering the *new* Type "M" Mult-Au-Matic at a price which is *lower than competitive methods*.

Designed and built according to exacting Bullard standards, the *new* Type "M" Mult-Au-Matic incorporates many new features of rigidity, accuracy and productivity which have made this machine famous the world over.

For complete information on the *new* Bullard Type "M" Mult-Au-Matic, call your nearest Bullard Sales Office or Distributor or write to

The Bullard Company, Bridgeport 9, Conn.

For the first time, standard numerical controls have been successfully retrofitted to a turret punch press. The 41P Wiedemann, high-production, turret punch press is now "in-production", fitted with Hughes' NC 41P—turret numerical controls.

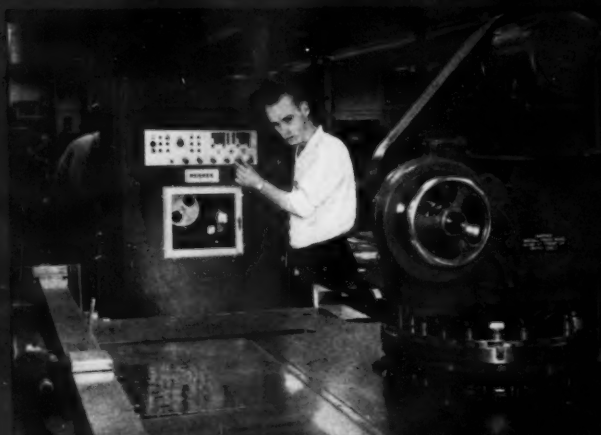
To accomplish the retrofit, Hughes added electrically driven lead-screws to the table, and binary coded decimal turret stations for turret position control. The operating costs reduced nearly fifty percent; the production of templates; realization rate improved against standard time; and lead time cut from one week to less than one day.

This engineering "break-through" demonstrates that Hughes Numerical Controls, with their "break-through" systems are built to cut your costs, increase production and improve quality.

Hughes Numerical Controls employ "break-through" technology, modular construction and photo-electric sensors. They offer you: high and repeatable accuracy; maintenance, simplified tape preparation, and a choice of two or three axis controls.

Find out more about "break-through" Hughes Numerical Controls. Write, with business (TWX 98GL 4117) or call direct: Hughes Industrial Control Systems, Dept. ENR 40017, P.O. Box 90004, Los Angeles 40, California. For export information please write: Hughes International, Culver City, California.

HUGHES
INDUSTRIAL CONTROL SYSTEMS
LOS ANGELES, CALIF. 90040
TELEPHONE (213) 551-1000
TELETYPE (213) 551-1000
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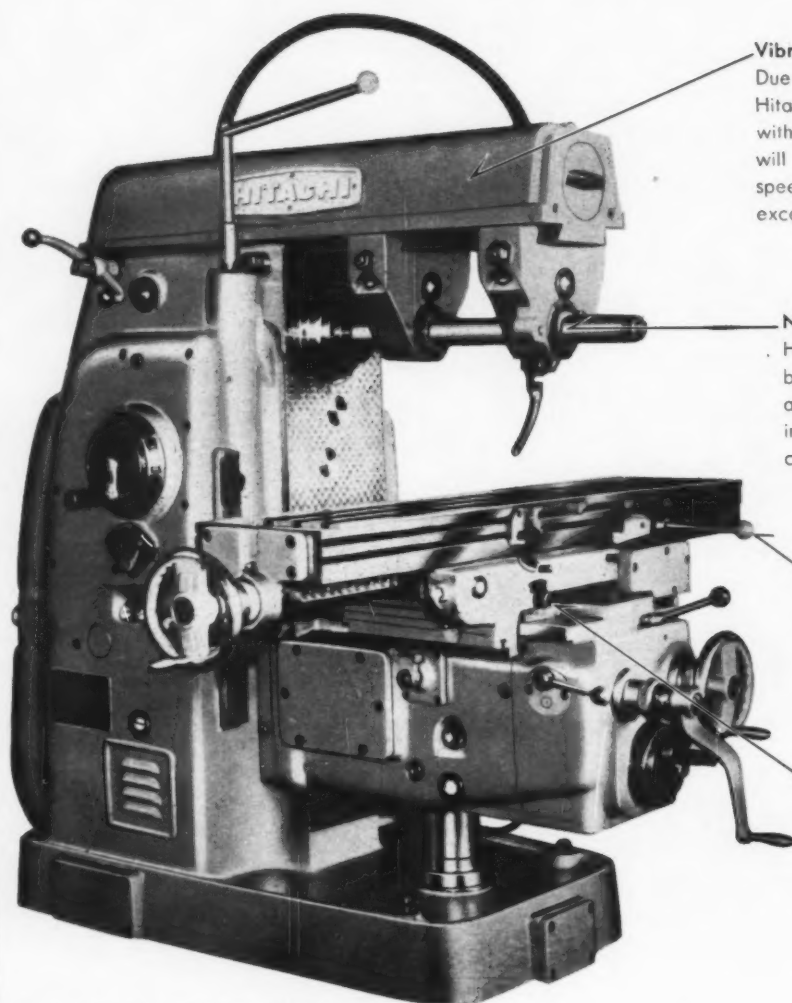
Wiedemann turret punch retrofitted with Hughes NC 41P.

How to cut punch press operating costs in half

Visit the Hughes booth at the ASTME Tool Show

HITACHI

NO.2 ML MILLING MACHINES



Vibration Damping Device

Due to a vibration damping device of Hitachi's exclusive design contained within the over-arm, minimum vibration will be set up even during higher speeds and feeds operation, so that an excellent finished surface is obtained.

New-Type Arbor Support Bearing

Hitachi's unique super precision-type bearing, a combination of plain metal and needle bearing, is incorporated into the machine to enable high speed cutting with high precision results.

Mono-Lever Control System

Hitachi's unique Mono-lever Control System makes the operation simple and easy. Table-feeding too can be performed with ease.

Backlash Eliminator of Lead Screw

As the use of two independent nuts eliminates backlash on the table feed screw, smooth down-cutting can be effected.

No. 2 ML Plain Milling Machine

SPECIFICATIONS :

- 53 1/8" x 10 1/16" Table
- 28" Longitudinal Traverse
- 16 Table Feeds 1/16" — 78 3/4"/min.
- 16 Spindle Speeds 25 — 1,500 r.p.m.
- 7.5 h.p. Main Motor



Hitachi, Ltd.

Tokyo Japan

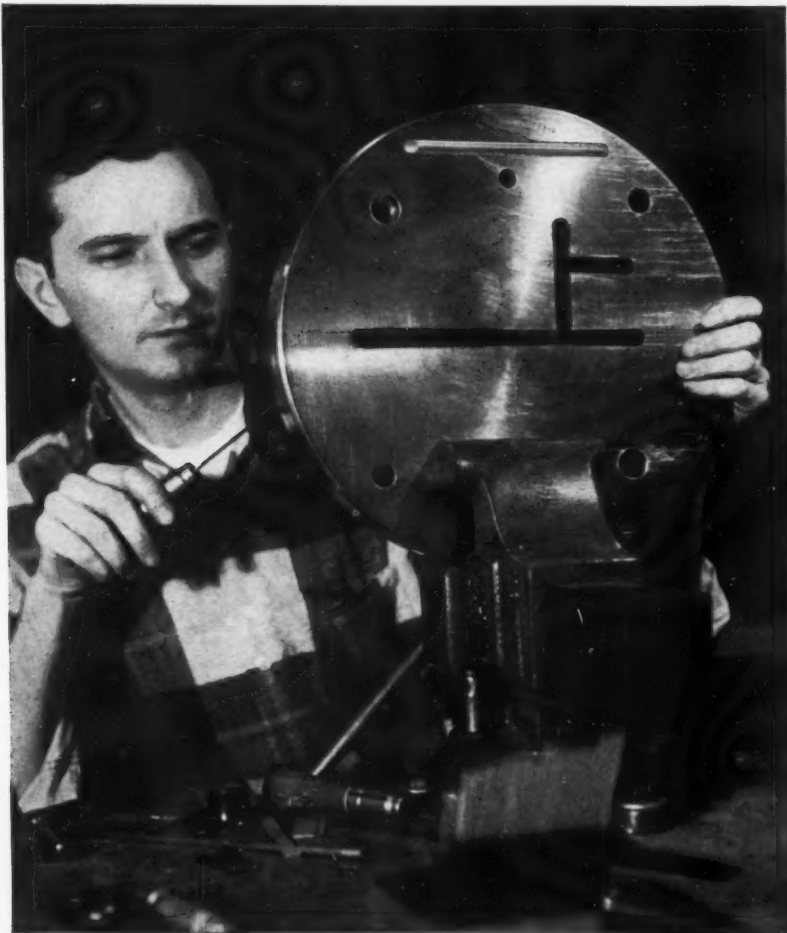
Cable Address : "HITACHY" TOKYO



Tool Steel Topics



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Office: Bethlehem Steel Corporation, New York, N.Y.



A Philadelphia Extruder Reports:

"DIES MADE FROM CROMO-WV DISCS WEAR WELL AT HIGH TEMPERATURES"

In the busy extrusion plant of Michael Flynn Manufacturing Co., Philadelphia, they're getting outstanding service from extrusion dies of Bethlehem Cromo-WV upset-forged discs. The dies, which extrude a variety of aluminum sections, are hardened to Rockwell C47-50. They are particularly impressive because of their long service, and their ability to withstand high-temperature operations.

Cromo-WV (H-12) is ideal for extrusions tooling because of its 5 pct chrome content and balanced analysis which give it high resistance to heat checking. And it has excellent red hardness, plus the ability to withstand shock and wear.

You're sure to like the economy and long service of dies made from Cromo-WV upset-forged discs. Place your order today with your Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Here's the Way to Grind Tools



After tools are hardened, it is customary to grind them to remove scale and decarburization, or to produce exact dimensions, or both. Basically, the aims are: removal of the desired amount of metal without damaging the hardened surfaces, and the most rapid development of the required surface finish.

It is usually recommended that hardened tools be ground with a vitrified aluminum oxide wheel of 24 to 80 grit. For example, a coarse grit, such as 24, should be used on Bethlehem Lehigh H . . . a high-carbon, high-chrome grade (D-2).

The finer grits can be used on Cromo-WV hot-work grade (H-12). The use of soft wheels is suggested. Effective cooling should be done at the point of wheel contact, by using adequate cooling fluid. About .002 to .003 in. should be removed per pass for roughing cuts, and .0005 in. per pass (or less) for finishing cuts.

Hand-stone or fiber-wheel brush the tool edges after grinding, to remove burrs. In many shops, these operations have been replaced by a finish grinding pass with a 320-grit wheel. Properly applied, this pass leaves no burr.

BEAT THE WATCH

with time-saving STRIPPIT hole punching units

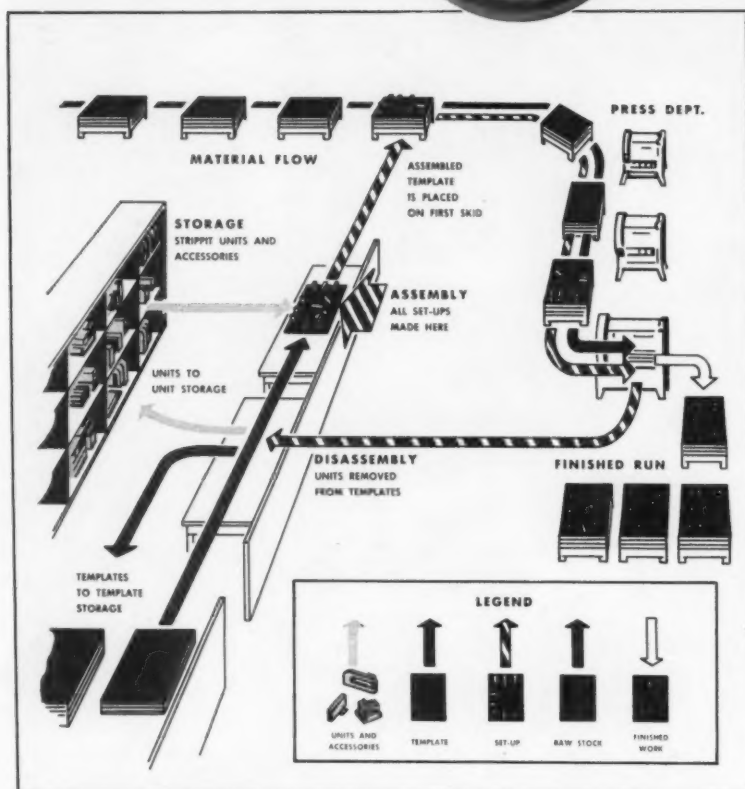


A stop-watch measures *dollars and cents* when it measures the time you spend setting up tooling. But the STRIPPIT System reduces hours to minutes and seconds...releases high bracket tool designers, die makers and die setters for work on more complicated dies involving forming, drawing and other operations.

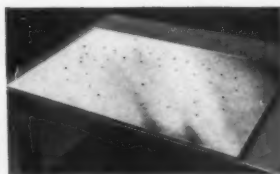
All it takes is a good mechanic to make STRIPPIT setups on bedrails, T-slotted plates or drilled templates. The latter are particularly valuable in saving press down time because the complete setup can be inserted as soon as the previous press run is finished.

STRIPPIT self-contained hole punching units come in a multitude of sizes and capacities to meet any pattern requirement. Newest of these are the "BN" and "CJ" series which can be used for punching round or shaped holes. Also available are notching units and units for punching angles and extrusions. Write now for the STRIPPIT General Catalog.

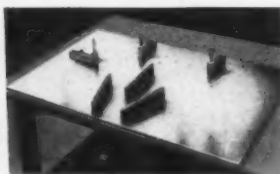
See you at the
Tool Show... booth 1305



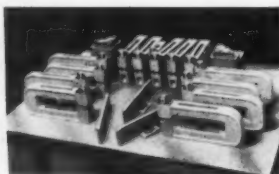
Typical STRIPPIT setup takes only 25.33 minutes from work order to finished piece



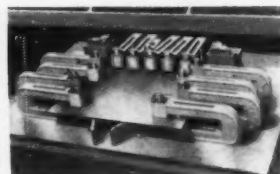
The STRIPPIT System begins with examining the blueprint, selecting the pre-drilled template and placing on setup table.



Feed rails and work stops are mounted securely to the template according to the size and the shape of the blank.



Notching units and hole punching units are mounted. Pilot pins concentric with punch assure precise positioning.



Complete setup is inserted in press and bolted down, shut height is adjusted and first piece punched and checked.

WALES STRIPPIT INC.

203 Buell Road • Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario

In Continental Europe: Raskin, S. A., Lausanne, Switzerland

In the British Isles: E. H. Jones (Machine Tools) Ltd., Hove, Sussex, England



COPPER FOR CONDUCTIVITY TEAMS UP WITH STEEL FOR STRENGTH



**...in a compact, low-maintenance conductor system
for heavy-current industrial applications**

The copper-headed steel conductor rails, shown above, of the Ringsdorff Carbon Corp., East McKeesport, Pa., help provide many economies in con-



The heart of the Ringsdorff Current Conductor System—the copper-headed steel conductor rail and pantograph current collector with a graphite carbon shoe. Components, including rail hangers and joints, are available in a wide variety of sizes, with capacities up to 2000 amps, for either a-c or d-c systems

ductor systems for such heavy-current users as traveling cranes, ore bridges, monorails—using either a-c or d-c.

The system is simple and compact. One basic steel shape provides strength and simplifies installation. Over it is cold drawn the copper head of extruded Anaconda ETP Copper-100, in the size to meet individual current requirements. (Copper-headed conductor rail, left, 500 amps; right, 1500 amps.) Less space is needed; installation is easier than with aluminum rails.

Long life and low maintenance. The special Ringsdorff carbon graphite used in sliding contacts has an affinity to copper, putting down a film that lubricates its passage and protects the rails. Wear on the copper head is negligible over periods of 20 to 25 years. Only

maintenance is replacement of carbon shoes, having an average life up to 3 years. Aluminum rails must be protected by lubrication or they will wear and pit—when out of use for a period may develop an insulating oxide film.

This is another illustration of the way the unique properties of copper are being utilized in industry to do things better—at lower cost. Anaconda has teams of specialists available to sit down with members of your organization to help select the alloys and forms of metal to solve your value analysis problems. For such technical help, see your Anaconda representative, or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

6347

ANACONDA®

COPPER BRASS BRONZE NICKEL SILVER MILL PRODUCTS

Anaconda American Brass Company

SOCIÉTÉ ALSACIENNE DE CONSTRUCTIONS MÉCANIQUES

**TV
162**



HEAVY DUTY SINGLE COLUMN BORING MILL

Table diameter.....	63" (1600 mm)
Maxi turning diameter.....	71" (1800 mm)
Maxi distance under main rail.....	51.5" (1300 mm)
Power of the variable speed driving motor.....	80 HP
Weight of machine.....	28.5 tons
Machine totally controlled from the pendant panel	

on request : — electro-magnetic copying device for both sliding rams
— adjustable feed stop provided for final hand setting
— thread cutting device
— coolant system

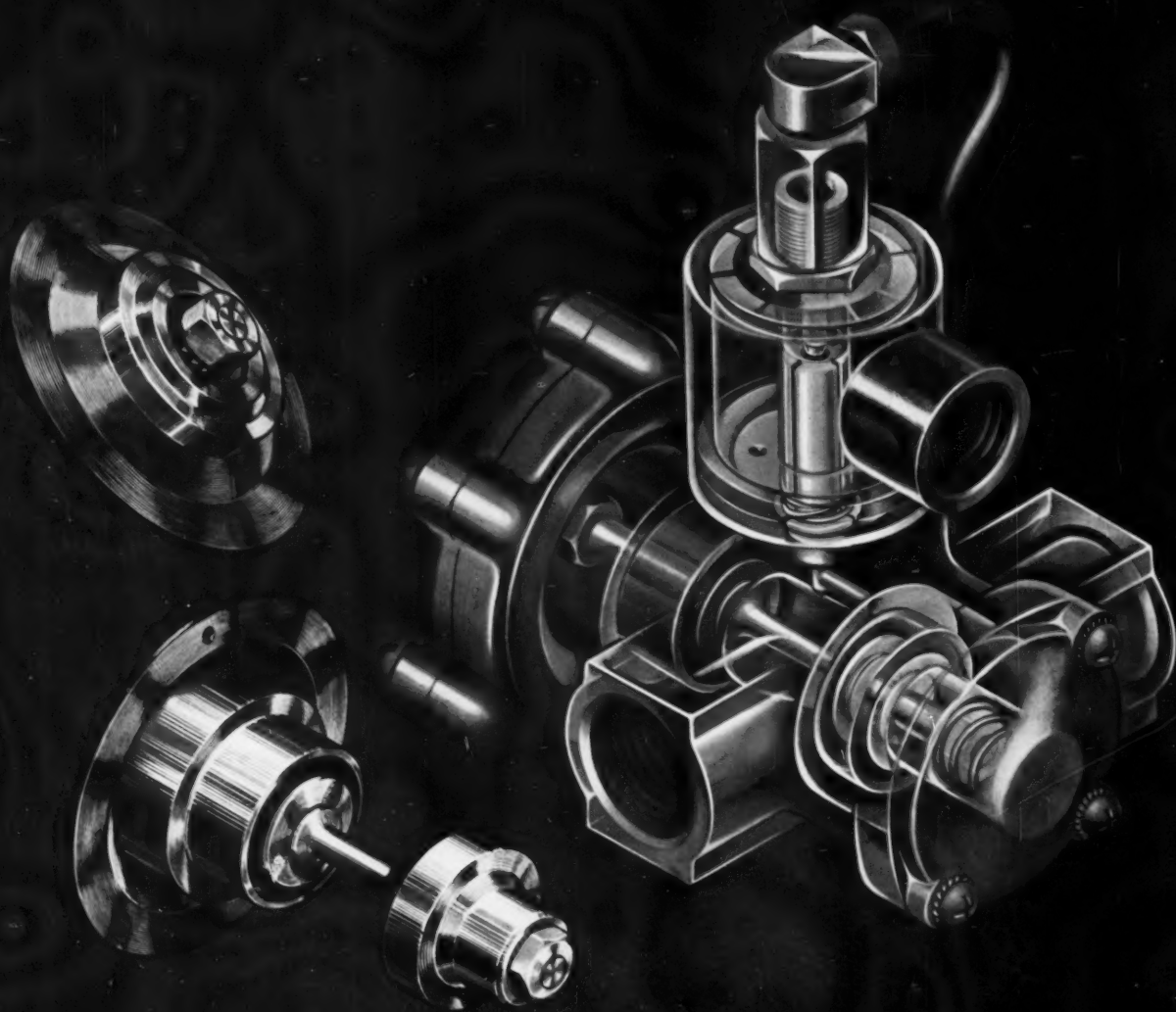
OTHER PRODUCTS

GRAFFENSTADEN

Universal combination millers
Knee type milling machines
Bed type millers
Base type production millers
Planer type milling machines
Radial boring machines
Single column vertical boring mills
Boring and milling machines
— table type
— floor type
— planer type
Ram-type milling and boring machines

GRAFFENSTADEN WORKS (BAS-RHIN) FRANCE

For more information, write to S.A.C.M., 3 Channing Place, Cambridge 38, MASS., Tel. EL. 4-8043
or to S.A.C.M. Graffenstaden - Bas-Rhin (France) 156, route de Lyon - Tél. : Strasbourg 34.92.00



SKINNER 2-way and 3-way Solenoid Valves

for high flow, heavy-duty industrial use

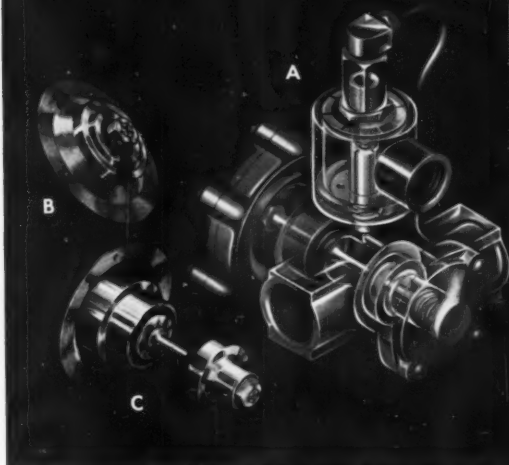
Skinner combines unique diaphragm assembly and V5 solenoid operator in new L Series valves

Skinner has now combined its famous V5 solenoid operator with a unique diaphragm assembly in a new line of two-way and three-way valves—the versatile L Series.

Unusually long life is assured by this new diaphragm assembly. The 3-way diaphragm consists of two tough laminates of nylon fabric coated with a Buna-N rubber separated by a thin Teflon disk. The assembly is virtually 100% supported in the open and closed positions with only a very

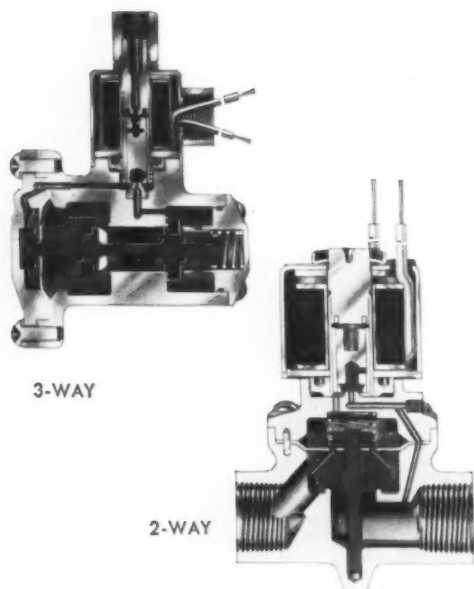
small area exposed to pressure differential during operation. Life tests show that this type of diaphragm far out-performs all others tested.

The two-way diaphragm and spindle assembly supports a seal retainer and soft, synthetic seal which provides bubbletight sealing of the main orifice. This seal fits on a shoulder which extends beyond the seat and helps to cushion the closing motion—thus minimizing water-hammer.



A—Transparent view of normally closed 3-way solenoid valve
B—Front view of diaphragm assembly
C—Spindle seal retainer and diaphragm assembly

Low cost 2-way and 3-way valves to meet your high flow industrial requirements



3-WAY

2-WAY

Cutaway views of 2-way and 3-way valves showing how the unique diaphragm assembly and solenoid operator are combined in these new valves.

Skinner L Series solenoid valves feature forged naval brass bodies, stainless steel and brass internal parts. They are available normally closed, normally open and directional control in standard and explosion-proof construction.

In addition to the many exclusive features, these Skinner valves are low in price, and with one

model—a 2-way normally closed valve—available at especially low budget cost.

All 3-way and 2-way normally open valves are supplied with a piped exhaust return. For catalogs and complete information, contact a Skinner Distributor listed in the Yellow Pages or write us at the address below.

SKINNER L SERIES SPECIFICATIONS

	TWO-WAY	THREE-WAY
Pipe Sizes, NPTF	$\frac{3}{8}$ "*, $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1"	$\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ "
Orifice Sizes	$\frac{1}{2}$ ", $\frac{3}{4}$ ", 1"	$\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ "
Operating Pressure Differential	Minimum 5 PSI Maximum 150 PSI	5 PSI ($\frac{3}{4}$ " 10 PSI) 150 PSI
Position	Normally closed, Normally open	Normally closed, Normally open, Directional control
Leakage	Bubbletight	Bubbletight
Temperature Range (Ambient and Media) *has $\frac{1}{2}$ " orifice	Minus 40°F to plus 180°F	Minus 40°F to plus 180°F

When you specify solenoid valves, specify Skinner.

Skinner solenoid valves are distributed nationally.



THE CREST OF QUALITY

SKINNER ELECTRIC VALVES

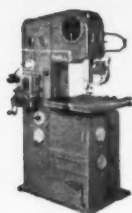
SKINNER ELECTRIC VALVE DIVISION
SKINNER PRECISION INDUSTRIES, INC. • NEW BRITAIN, CONNECTICUT, U.S.A.

PRINTED IN U.S.A.

YOU CAN HIRE THESE NEW MACHINES

AT THESE LOW HOURLY "WAGE RATES" (BASED ON A 40-HOUR WEEK)

CONTOUR MACHINE 1



55¢ per hour

For contour
sawing, filing
polishing

UTILITY MACHINE 2

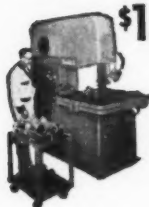


17¢ per hour

Light-duty
all-purpose
manual operation

It's the way many alert companies are beating the profit squeeze—getting the benefit of newest and most productive machines without capital investment. Here are 16 typical DoALL machine tools showing their hourly rental cost for a normal work week. These figures show the extremely low hourly cost of machines which earn many times their "wage rate." And DoALL's Rental Plan includes the option to purchase. Use the coupon below for further details.

CONTOUR-MATIC* 3



\$1.66 per hour

Fixturable
table
power feed
uses H55
saw bands

BAND FILER 4



17¢ per hour

Accurate
high-speed
filing work

POWER SAW 5



44¢ per hour

For hand-
operated
cut-off
work

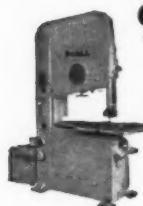
LAPPING MACHINE 6



63¢ per hour

Ultraprecision
dimension
finishing

ZEPHYR MACHINE 7



99¢ per hour

High-speed
and friction
sawing

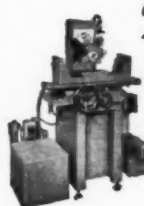
POWER SAW 8

Automatic
heavy-duty
cut-off work



\$1.21 per hour

SURFACE GRINDER 9



23¢ per hour

Precision
manual
operation

SURFACE GRINDER 10



74¢ per hour

Production
precision
automatic
operation

BAND MILL 11

\$5.01 per hour



For slabbing
shanking
refacing

ANGLE POWER SAW 12



\$1.07 per hour

Automatic
angular cuts
up to 45°

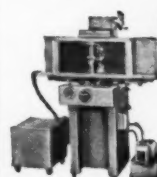
I/D MICRO-SLICER 13



\$1.78 per hour

Automatic
precision
slicing
semiconductors

MICROTOM-ATIC* 14



62¢ per hour

Manual
precision
slicing and
dicing

PAN-ARM* SAW 15

\$6.98 per hour

Contour
cutting
huge
parts



CONTINENTAL PRODUCTION SAW 16

\$3.07 per hour

For continuous
heavy-duty
cut-off work
T. carbide
saw bands



*Reg. T.M.—The DoALL Company

MAIL THIS COUPON TODAY!

THE DoALL COMPANY Des Plaines, Ill. B-65A

We want more information on the machines checked

HERE:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Name _____

Company _____

Address _____

City _____

Zone _____ State _____

ACCURACY AND GRIP...



When you buy new tools or rebuild old ones

START UP FRONT

- Precisely the point where the tool does its work.
- Precisely the point where profits are made and lost.
- Precisely the point where the accuracy and grip of Jacobs Chucks reduce tool breakage, downtime and rejects.

This is precisely the point, start up front with Jacobs.

Finest machinists everywhere know the Jacobs Plain Bearing Chuck as standard equipment for portable power tools. They know it for *precision accuracy* and *powerful grip*... the most widely used chuck in the world.

INDUSTRIAL TEAMWORK

Your industrial supply distributor knows your business. He is always ready to fill your needs quickly and economically. When you need chucks you can depend on this industrial team—Jacobs and your Jacobs industrial supply distributor.

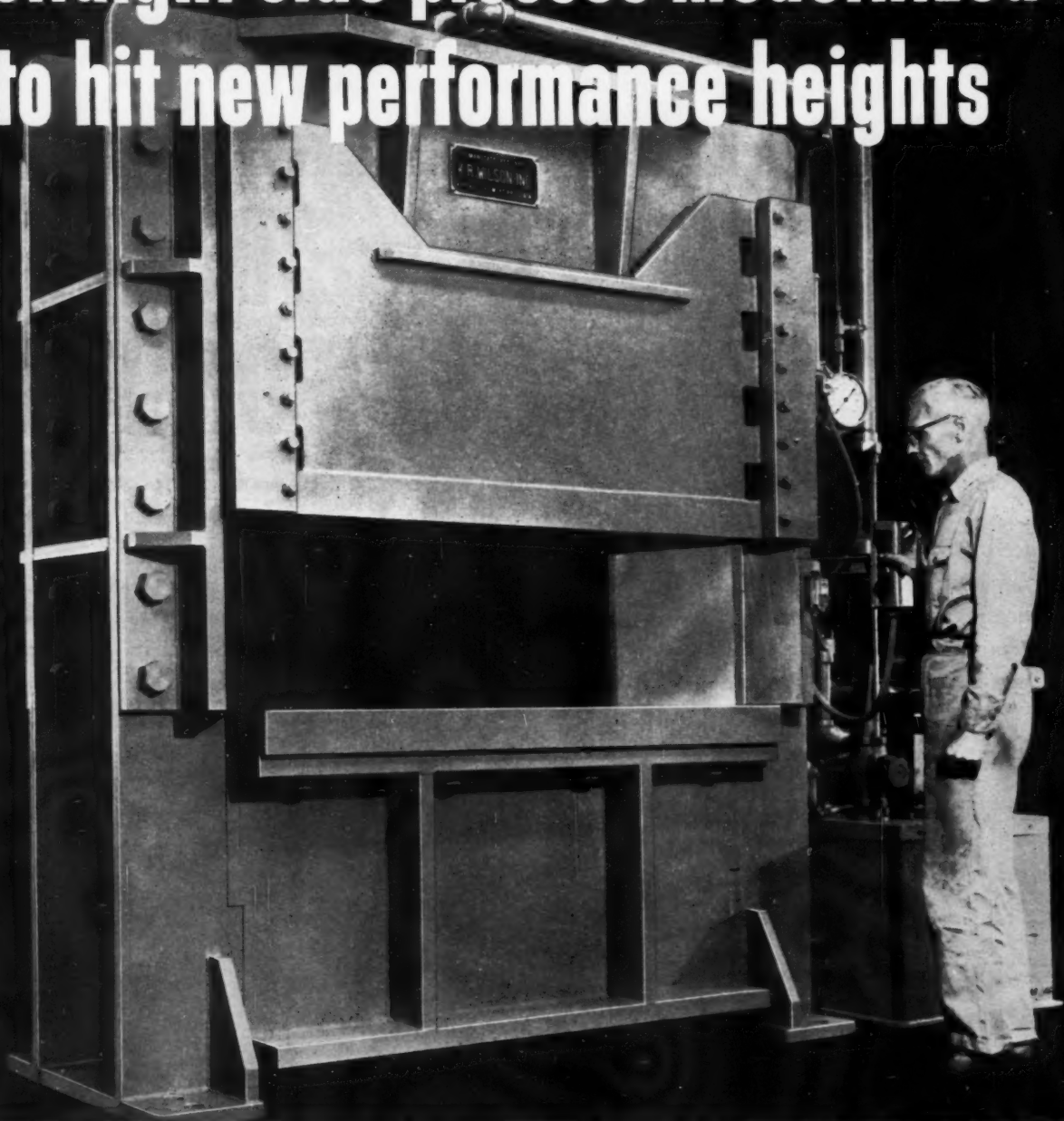


Jacobs

CHUCKS

THE JACOBS MANUFACTURING COMPANY,
WEST HARTFORD, CONNECTICUT

straight side presses modernized to hit new performance heights



Here's smooth hydraulic action at its best! Newly modernized, the KRW 25-1000 ton line of straight side, single action presses offers you the most profitable answer to a wide range of work: bending, forming, blanking, briquetting, broaching, coining, embossing, forging, straightening and trimming.

Boasting clean-cut, neat exteriors, these versatile machines have been engineered to improve productivity . . . *quantity-wise, quality-wise and dollar-wise!*

KRW's rugged, welded frame construction is unequalled for strength and rigidity. Members are keyed and fitted together to insure precision performance. Angle gibs, located at each corner of the sliding platen, maintain platen-to-bed parallelism to make utmost accuracy and longer die life a certainty.

Available with either up-acting or down-acting platens, KRW Straight Side, Single Action Presses can be outfitted with manual lever or electric push buttons for single or continuous cycling. Compact, easy-to-adjust and fully responsive, KRW hydraulic systems assure instant, complete press control.

More detailed information (including specs) can be obtained by writing for illustrated Bulletin 5-B. K. R. Wilson, Inc., 214 Main St., Arcade, N. Y.

KRW HYDRAULIC PRESSES

BENDIX PROVIDES SYSTEMS EXPERIENCE TO MAKE NUMERICAL CONTROL WORK FOR YOU

Numerical control is a proved concept in metalworking. It has demonstrated its worth in scores of applications, but perhaps your manufacturing problems are different. Why not enlist the services of Bendix—long-time supplier of practical, reliable numerical control systems to most major machine tool builders. Let us be your prime source of information and assistance when the demand for increased productivity indicates a need for more modern equipment that will reduce scrap, reduce lead time, reduce inventory costs, and reduce tooling costs. Whether it's contouring, positioning or measuring, Bendix has the solution to your particular problem.



Versatility of Bendix DynaPath contouring controls is illustrated by this machine tool which will grind, turn or mill in two or three axes, with 0.0001-inch tool path accuracy.

YOU NEED BENDIX SYSTEMS EXPERIENCE when you consider numerical control for your application! Bendix offers:

- 1 JUSTIFICATION STUDIES**—what can numerical control do for you?
- 2 SYSTEM ENGINEERING**—applying the right control to the right machine tool.
- 3 TRAINING AND SERVICE**—for maximum machine utilization rates.

The unique Bendix Systems Experience is backed up by a staff of experienced electronic, mechanical and hydraulic engineers, mathematicians, instructors, technicians, and parts planners. Our contract machining and tape-making facilities offer years of accumulated case histories on all manner of applications *and* a chance to check out *your* problems in actual practice. Why not write today for more information on Bendix Systems Experience.

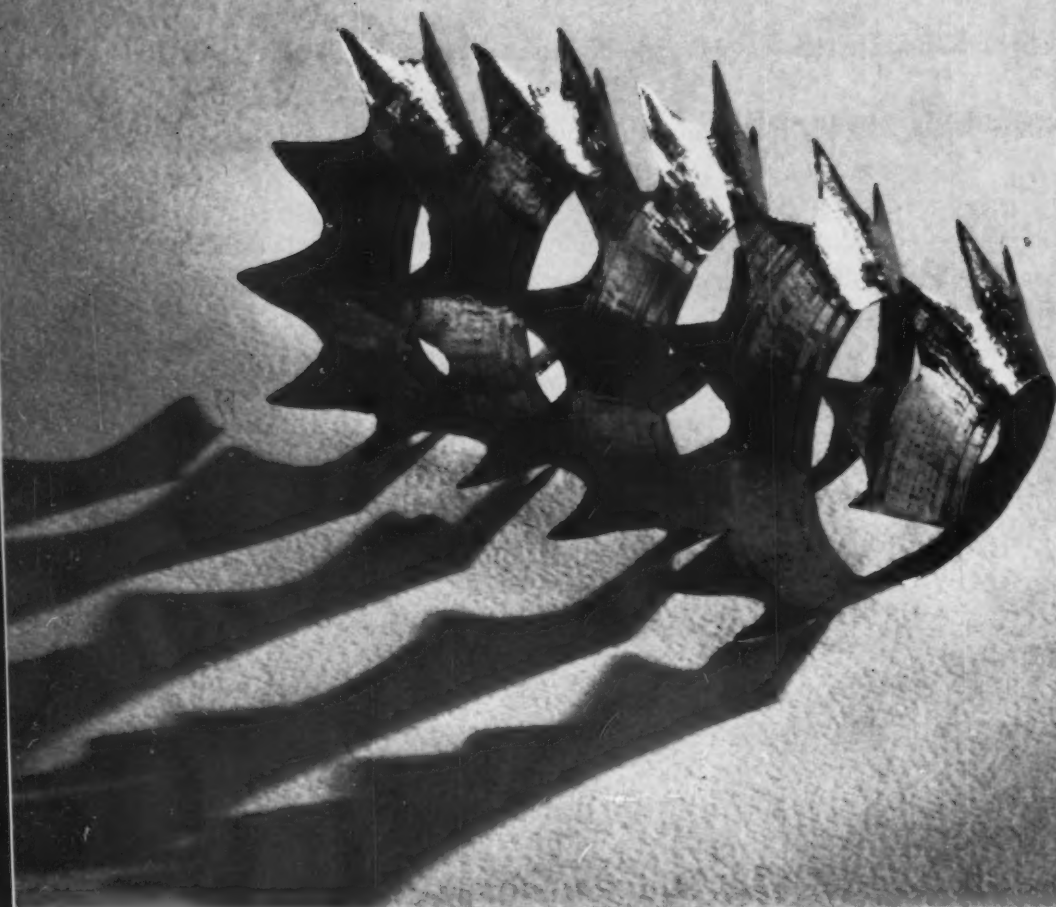
Industrial Controls Section

21820 Wyoming Ave., Detroit 37, Michigan

A black and white photograph of a man in a dark suit, white shirt, and dark tie, wearing a bowler hat. He is walking towards the right, carrying a dark briefcase in his right hand. The briefcase has the "Bendix SYSTEMS EXPERIENCE" logo on it. He is standing in front of a large, dark industrial machine, which appears to be a machine tool with a control panel. The background is dark and industrial.

For tool room work, Bendix DynaPoint positioning systems can hold 0.0001-inch tolerances on this jig borer.

With Ferranti numerical control, this turret drill will do the work of several conventional machines, and reduce scrap.



Chip — magnified 4 times — produced by machining Waspalloy with Rex 49

New Rex 49 outlasts other special purpose high speed steels better than 2 to 1

Rex 49 — a new high speed steel that can machine today's "difficult-to-cut" metals *faster and more economically* than existing special purpose high speed steels — is another in the long line of advances and improvements in specialty steels to come from Crucible research.

Crucible laboratory tests indicate that tools made of Rex 49 last as much as 4 times longer than other special purpose high speed steels . . . and it has a base price $\frac{1}{2}$ to $\frac{1}{2}$ of these steels.

Both laboratory and field reports prove the advantages of Rex 49 for machining hard, tough or abrasive metals,

such as heat-treated alloy steels, stainless, titanium, and superalloys. These tests also indicate that Rex 49 has advantages in machining the more conventional metals through increased speeds, feeds and depths of cut — and Rex 49 can be hardened with conventional high speed steel heat treating equipment.

Rex 49 is indicative of Crucible's continuing leadership in the development of improved high speed and tool steels.

For more information, write: *Crucible Steel Company of America, Dept. HE20, Four Gateway Center, P. O. Box 88, Pittsburgh 30, Pa.*

CRUCIBLE

STEEL COMPANY OF AMERICA

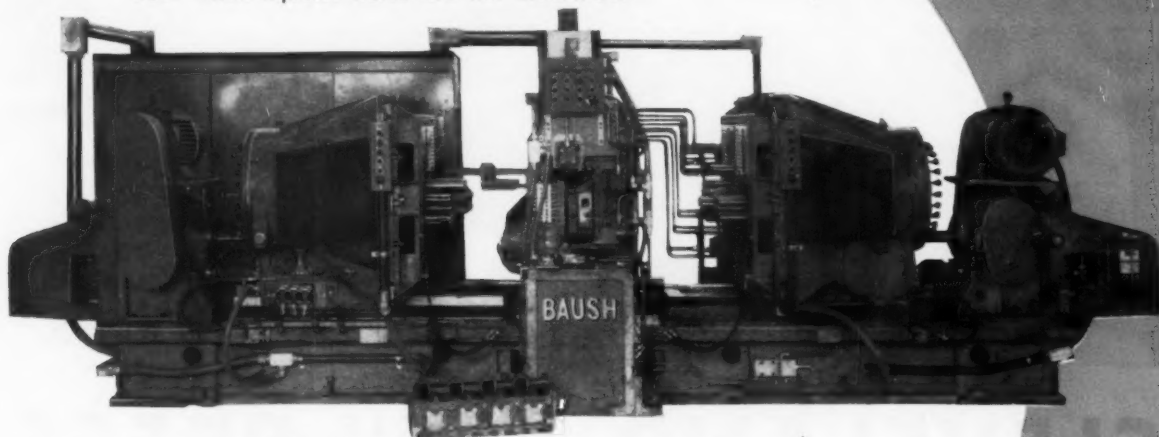
IRREGULAR HYDRAULIC FEED vs SMOOTH, CLEAN MECHANICAL FEED—

is easy to recognize when you watch machines like this BAUSH 2-WAY HORIZONTAL "M-25" MECHANICAL SCREW FEED in operation, because - - -

- No hydraulic fluid is needed — a real savings
- No fluid leaks or feed fluctuations — reduces maintenance
- No "break-thru" surge — reduces work spoilage
- Positive, smooth ball-screw feed — saves breakage
- Part spoilage and tool breakage is reduced to minimum
- Your own mechanic can maintain units — reduces cost

PRODUCTION:

Designed specifically for drilling, counter-boring, reaming and forming valve seats, this machine finishes 12 cylinder heads an hour when machining injector holes, and 18 per hour when injector holes are not machined.



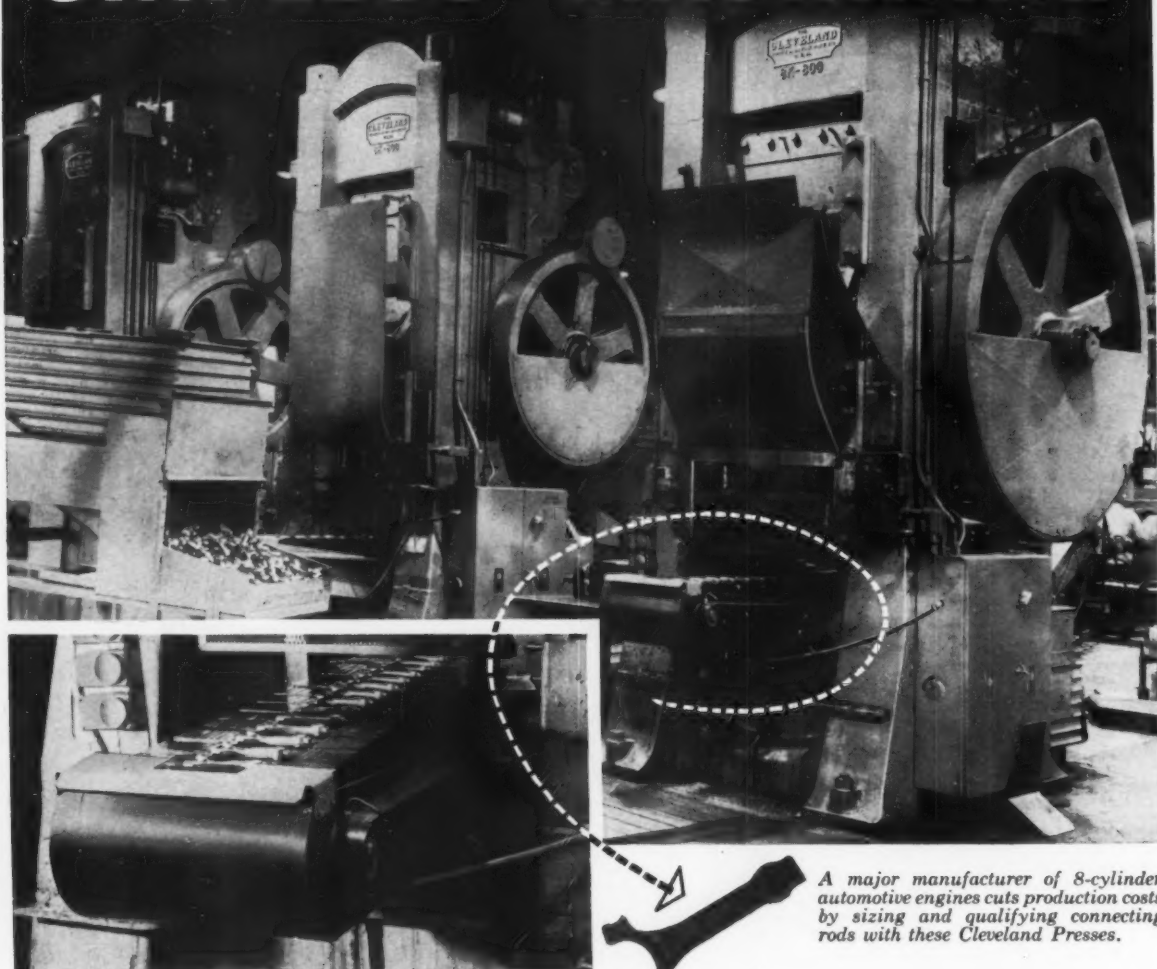
SPECIFICATIONS:

This Baush machine is fully automatic — has two 27" x 50" drilling heads with a total of 76 spindles with each spindle arranged for two speeds and a neutral position. The master-bored cluster plates have slip-sleeve spindles and entire unit has Trabon lubrication throughout.

Fixtures are transfer bar type; fully automatic to accommodate three different size cylinder heads. Base is arranged for chip conveyor disposal and the 5 motors and electrical controls are J.I.C.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

CHIPLESS MACHINING



A major manufacturer of 8-cylinder automotive engines cuts production costs by sizing and qualifying connecting rods with these Cleveland Presses.

CLEVELAND KNUCKLE JOINT PRESS

Fully automated with chain-type conveyor feed, these three 800-ton Cleveland Knuckle-Joint Presses eliminate expensive machining operations. Cleveland's massive, carefully fitted knuckles exert a "super" squeeze on the cold metal that straightens the part, sizes it to close tolerance of the order of .0005".

This "chipless machining" is cutting costs in forge shops and automotive engine manufacturers due to the greater accuracy possible with Cleveland Presses. Cleveland's long slide bearing surfaces and rugged frame construction hold deflection to a minimum under maximum load.

With capacities from 150 to 3000 tons and bed areas from 18 x 18" to 50 x 54", Cleveland Knuckle Joint Presses do the job efficiently, economically. Investigate the COST-CUTTING advantages of these Cleveland Presses by writing today for Catalog K2.

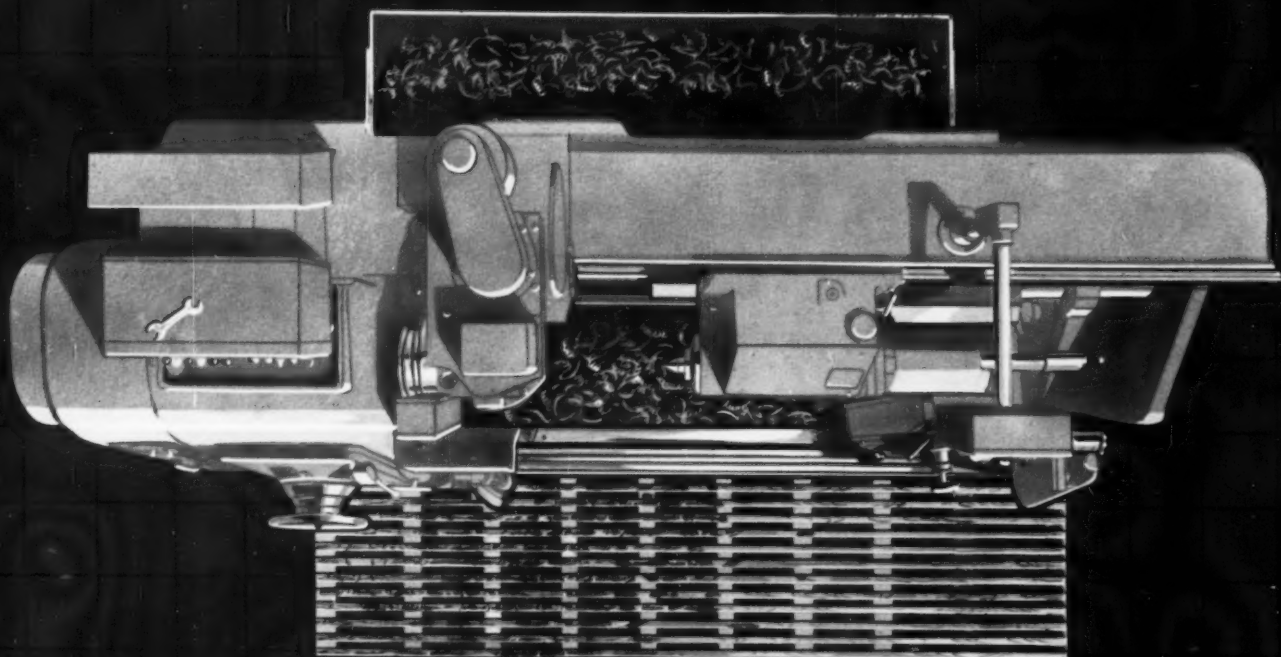
A-4001A

OTHER COST-CUTTING CLEVELAND PRESSES

INCLINABLE • STRAIGHT SIDED CRANK • STRAIGHT
SIDED ECCENTRIC • 4-POINT UNDERDRIVE • DOUBLE
ACTION TOGGLE



E. 40th and St. Clair Avenue, Cleveland 14, Ohio



You can turn a profit on a New Britain +GF+ Copying Lathe

Here's a birdseye view of a New Britain +GF+ Copying Lathe. It shows some important differences between this machine and conventional lathes with copying attachments. The point here is this—the *most effective use of the single-tool copy-turning principle can be made only with a machine designed from the ground up for this type of work.* The New Britain +GF+ is just such a machine. Notice the chip pan. It's big (it has to be) and located for easy removal of chips from the back of the machine. The design of the work area allows for unobstructed free-fall of chips out of the way and into the pan.

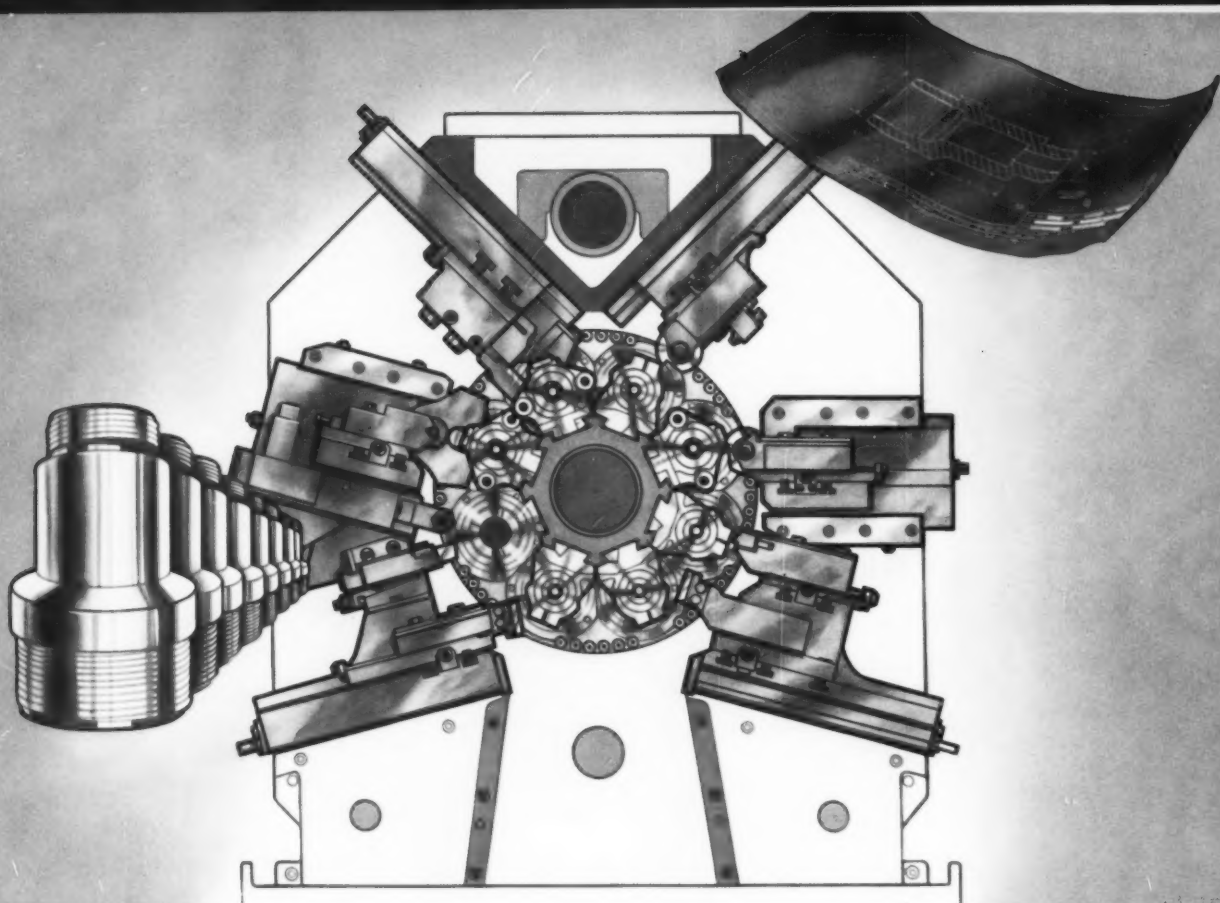
The New Britain +GF+ is massive and rugged, with plenty of power—up to 40 h.p., if you need it. It's simple to operate, quick to set up and change over. The single-point tool can be changed in one minute and it out-produces gang tooling setups in the bargain. Turning is controlled by

either a template or a prototype. External and internal copying are accomplished in one set-up with special tooling.

The possibilities for short or long run chucked and between centers work on the +GF+ are wide and varied. Because the work is produced with good surface finish and dimensional accuracy, grinding can be reduced and, in some instances, eliminated. Large diameters are broken down economically by successive parallel cuts, automatically if desired, with optional two-cut or multi-cut recycling.

You've got to see one of these machines in action to fully understand the kind and quantity of work they are capable of producing. Contact your New Britain Representative for demonstration arrangements or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut



Unlimited tooling combinations with New Britain Bar Machines

Nothing can out-date your operation quicker than better machines in the hands of a competitor. In the race to keep ahead on quality, price and delivery, nothing can put you out front faster than machines capable of consistently producing the highest quantity of finished pieces at the lowest possible cost. New Britain's new series of bar machines represents in every way the most advanced bar-turning units available. Each of the four-, six- and eight-spindle models has been re-designed, adding new features and improving older ones. Unlimited cross slide and end-working tool combinations, extremely fast operation (even on stainless) and a variety of models and features to choose from add up to some good reasons for incorporating New Britains into your replacement

or production expansion plans.

The eight-spindle model is the largest, most modern eight-spindle bar machine available. It has a stock capacity of up to $2\frac{5}{8}$ " and provides six independently-operated cross slides. As with all New Britain bar machines, the operations of the cross slides and end-working tool slide are disc-cam controlled for positive actuation, close tolerance machining and easy, rapid change-overs.

This is only a very small part of a story that is bound to interest you. The whole story and its significance in terms of your profits is available from your New Britain Representative. If you prefer, contact us directly at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut

in machine design or modernization...

Fawick simplifies clutch problems

... with standardized package design

Fawick Airflex Clutches and Brakes are easiest to use because they are incorporated into simplified *standard packages*, available in a wide range of sizes and capacities, and adaptable to all types of machines.

... engineering assistance

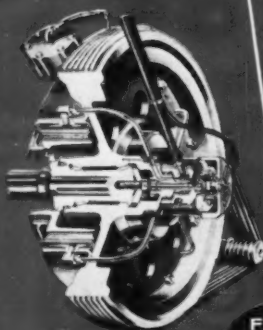
Fawick engineers, at the factory and in the field, are specialists in mechanical power transmission, ready to provide complete engineering service throughout all stages of design or modernization of machine drive systems.

... and increased production through top clutch performance

Fawick power transmission packages provide a sure method to increase production, as proved in thousands of applications in all major industries. Their unmatched performance record is based on drum-type air clutch design which provides instantaneous response, low maintenance, automatic self-adjustment for wear and positive safety.

FSPA (Fawick Standardized Press Application)

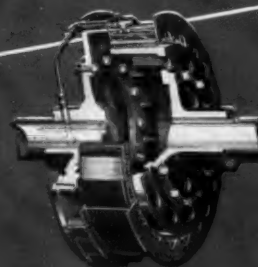
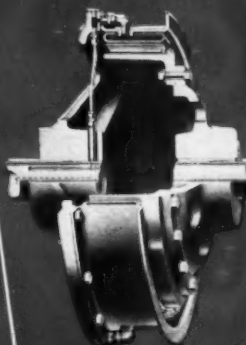
This clutch and brake package is designed for power presses and other high-speed cyclic machines requiring precise control of single, continuous or inching operations. Package includes CB Airflex Clutch, self-energizing CS Brake, Timing Rotorseal and high-speed clutch controls. On presses in the 5 to 150-ton range, FSPA units may be crankshaft-mounted in combination with flywheel, or clutch and brake may be mounted separately. FSPA is available in 25 sizes with torque capacities from 2,040 to 172,000 in.-lbs. at 75 psi.



FAWICK
controls best
by AIR

CB Airflex Clutch

Standard complete air clutch may be through-shaft mounted, or used as flexible clutch-coupling between shafts as shown. It compensates for both parallel and angular misalignment. Constricting type unit is designed for high-speed cyclic applications and general power transmission on all types of industrial machinery. It is available in 21 sizes with torque capacities from 2,040 to 1,130,000 in.-lbs. at 75 psi.



VC Ventortorque Clutch

Complete clutch package incorporates ventilated, constricting type clutch for extreme heavy duty applications involving high starting loads or sustained slippage. Rapid heat dissipation insures continuously high torque capacity. Unit may be through-shaft mounted or used as a clutch-coupling. Produced in both narrow and wide series, the VC Clutch is available in 14 sizes with torque capacities from 27,000 to 900,000 in.-lbs. at 75 psi.



Standardized CB Package Application

This small air clutch package may be through-shaft mounted on all types of cyclic machines having moderate power requirements. Tapered bushing construction in standardized bores and mountings simplifies installation and service problems. Package incorporates the CB Airflex Clutch, is produced in five sizes from 6 to 14-in. diameters, with torque capacities from 2,040 to 19,700 in.-lbs. at 75 psi.

For more information on how Fawick can simplify **your** clutch problem, call your nearest Fawick representative or the Home Office.

FAWICK AIRFLEX DIVISION FAWICK CORPORATION

9919 CLINTON ROAD • CLEVELAND 11, OHIO
Fawick Canada, Ltd., 60 Front St., West, Toronto, Ont., Canada

MACHINERY, May, 1961



For more data circle this page number on card at back of book

81

ARMSTRONG

TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

**Check over your ARMSTRONG Tool Holder needs.
Write for literature.**

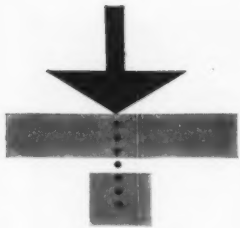


If you do not know the name
of your local ARMSTRONG
Distributor, inquire when
asking for literature.

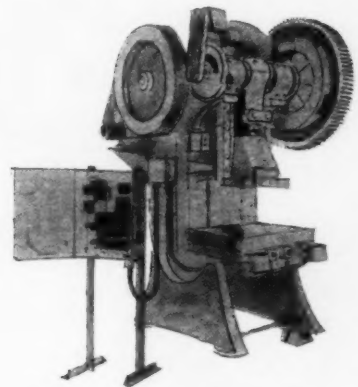
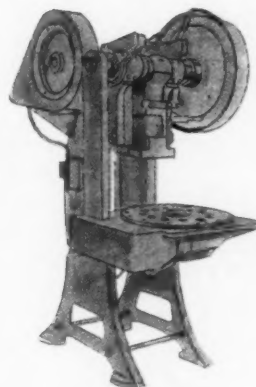
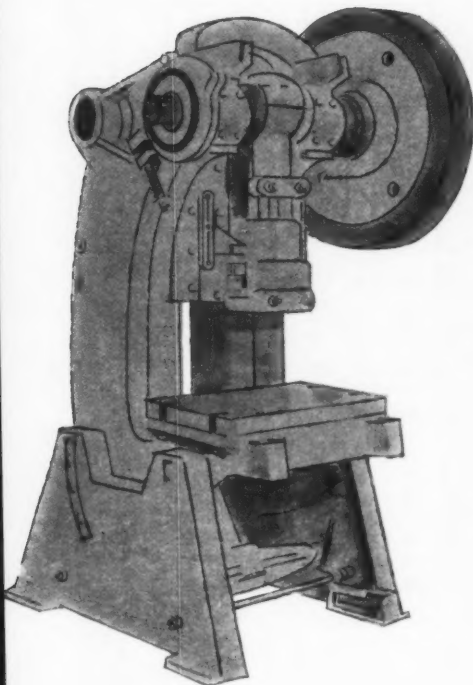
See Us at Booth #3906 ASTME Show
New York Coliseum

ARMSTRONG BROS. TOOL CO. 5213 W. ARMSTRONG AVE. CHICAGO 46, ILL.

Federal's dependability assures lower production costs— longer press life!



7 TO 125-TON CAPACITY



FEDERAL DIAL FEED PRESSES

Up to 20 multiple station operations — up to 300 indexes per minute. Hardened and ground indexing cam assures accuracy and smooth operation. Available with automatic parts-feeding and ejecting devices. Gear or chain driven. Safety mechanism protects dies.

FEDERAL AIR-CLUTCH PRESSES

The new Federal Friction-type Air Clutch is designed specifically for presses. Flywheel mounting reduces mass to be put into motion. Fast engaging and disengaging at any speed. Uniform torque distribution — shock-free engagement. Fail-safe operating controls.

FEDERAL GIVES YOU MORE!

Every Federal is built to your specifications with the highest quality materials, and Federal's well-known precision workmanship. The result — dependable service . . . lower production costs, and longer press life, even under the most rugged conditions. Check the quality features at the right. Then check with Federal on your next press requirements.

QUALITY FEATURES

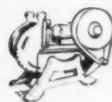
- Meehanite Cast Frames
- Replaceable Bronze Bushings
- Magnaflex Inspection
- Oversized Crankshaft Bearings
- Front-operated Recline
- Longer Rams and V-ways
- Exclusive Non-repeat Clutch Mechanism
- Timken Roller Bearing Flywheels

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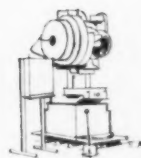
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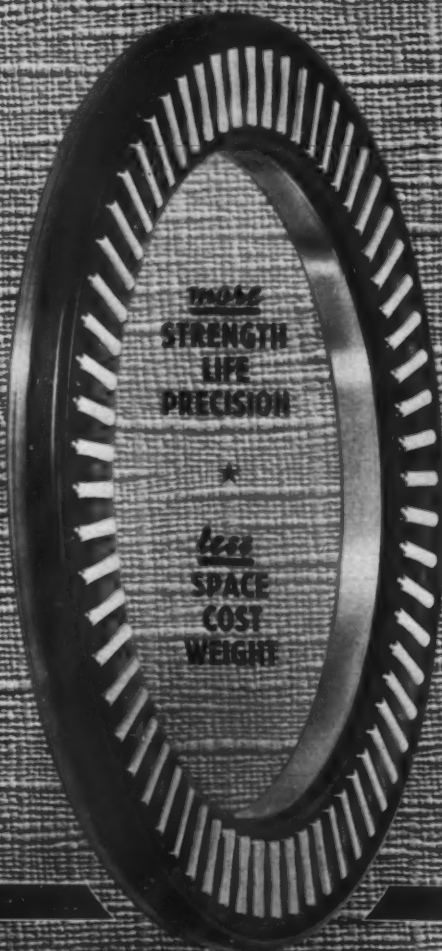


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Code	inside dia. mm	outside dia. mm	thickness mm
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AX 4 15 28	15	28	4
AX 4 17 30	17	30	4
AX 4 19 32	19	32	4
AX 5 20 35	20	35	5
AX 5 25 42	25	42	5
AX 5 30 47	30	47	5
AX 5 35 53	35	53	5
AX 5 40 60	40	60	5
AX 5 45 65	45	65	5
AX 5 50 70	50	70	5
AX 6 55 78	55	78	6
AX 6 60 85	60	85	6
AX 6 65 90	65	90	6
AX 6 70 95	70	95	6
AX 6 75 100	75	100	6
AX 6 80 105	80	105	6
AX 6 85 110	85	110	6
AX 8 90 120	90	120	8
AX 9 100 135	100	135	9
AX 9 110 145	110	145	9
AX 9 120 155	120	155	9
AX 11 130 170	130	170	11

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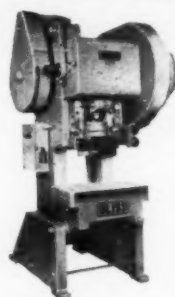
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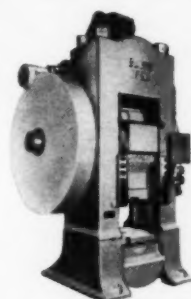
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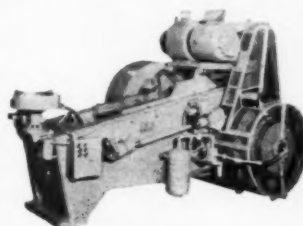
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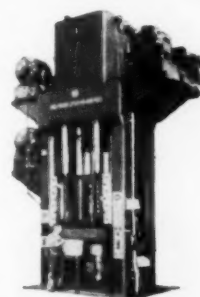
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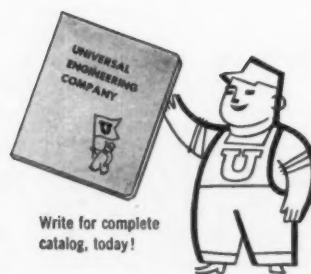
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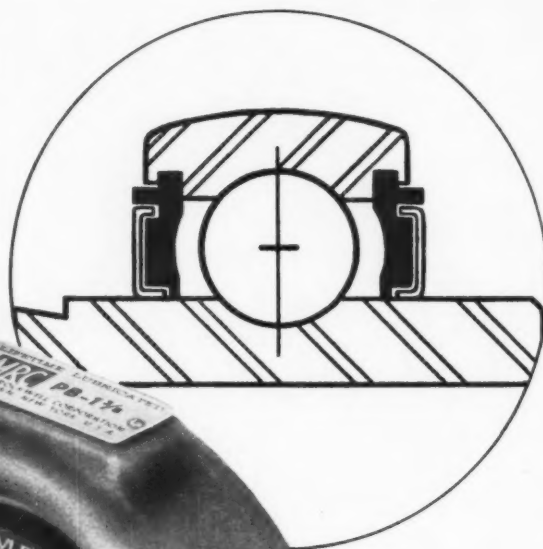
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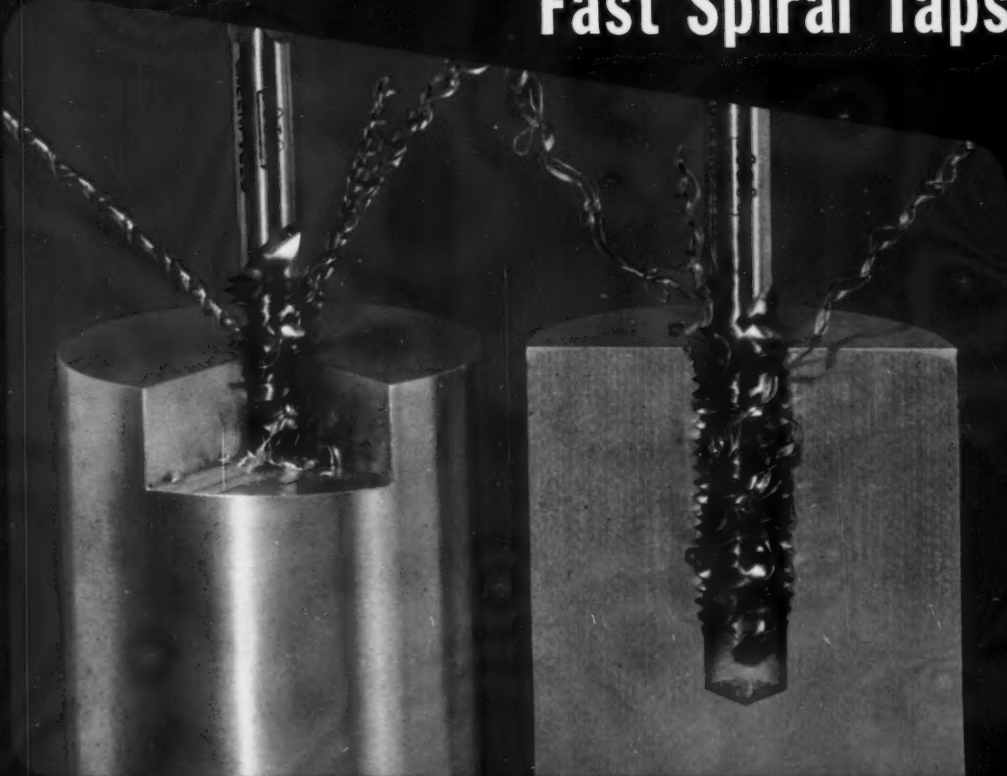
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Fast Spiral Taps



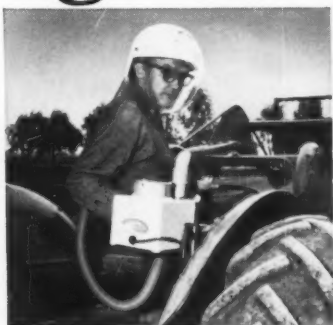
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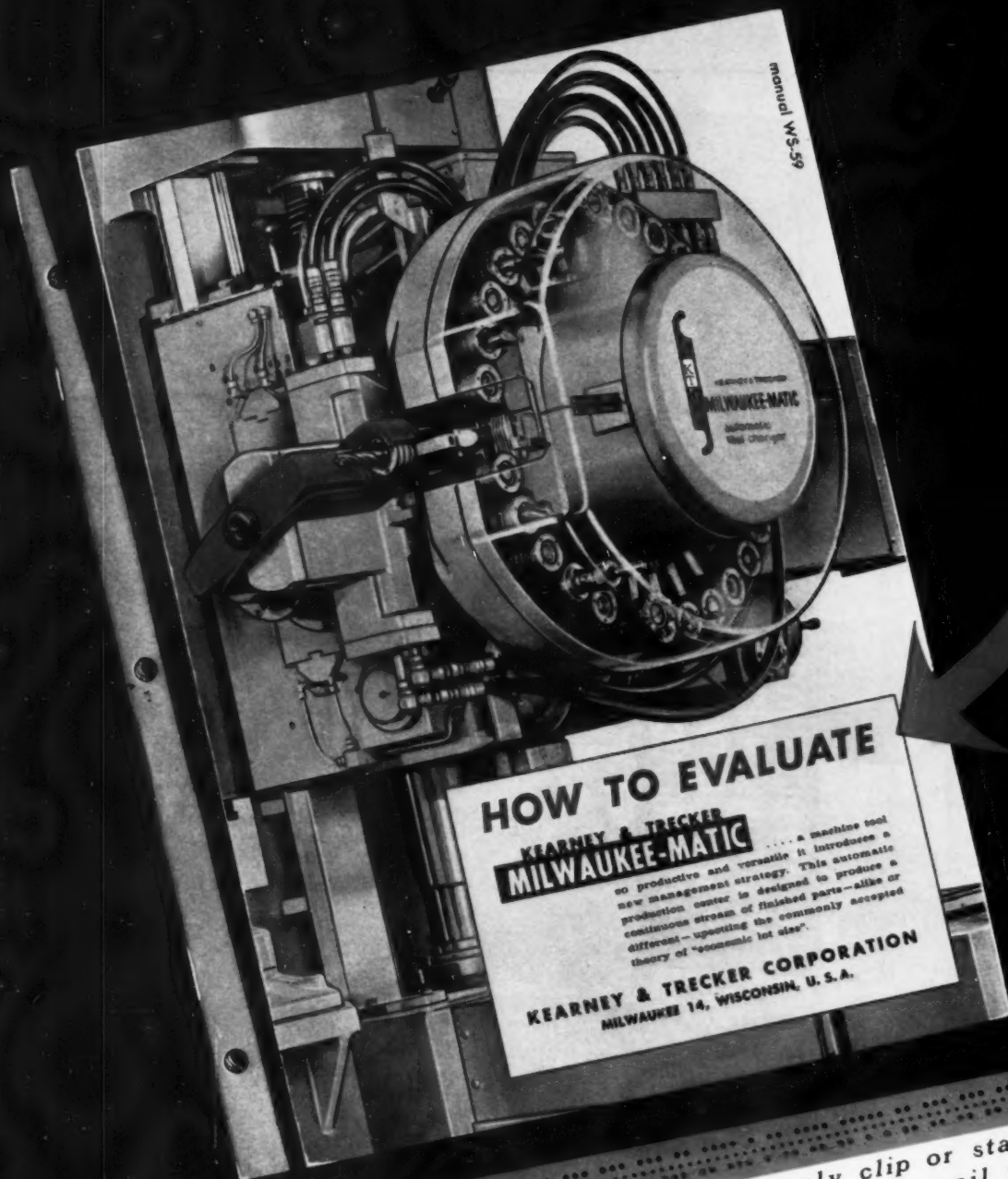


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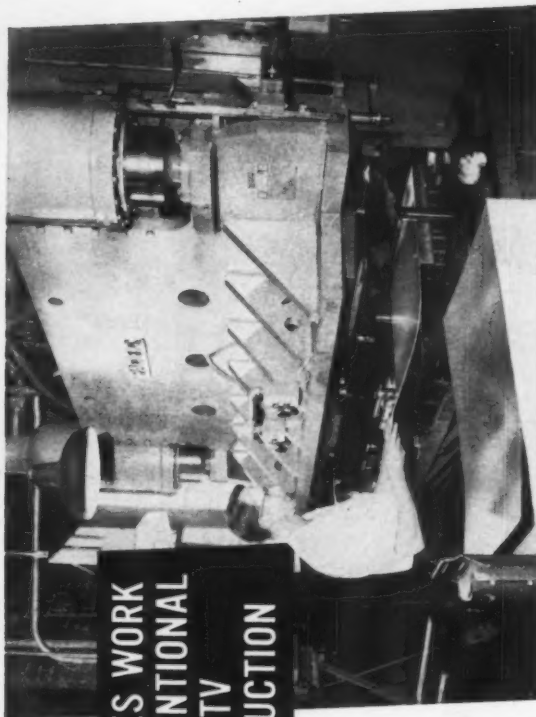
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- Overhead integral power unit for increased accuracy (1955)
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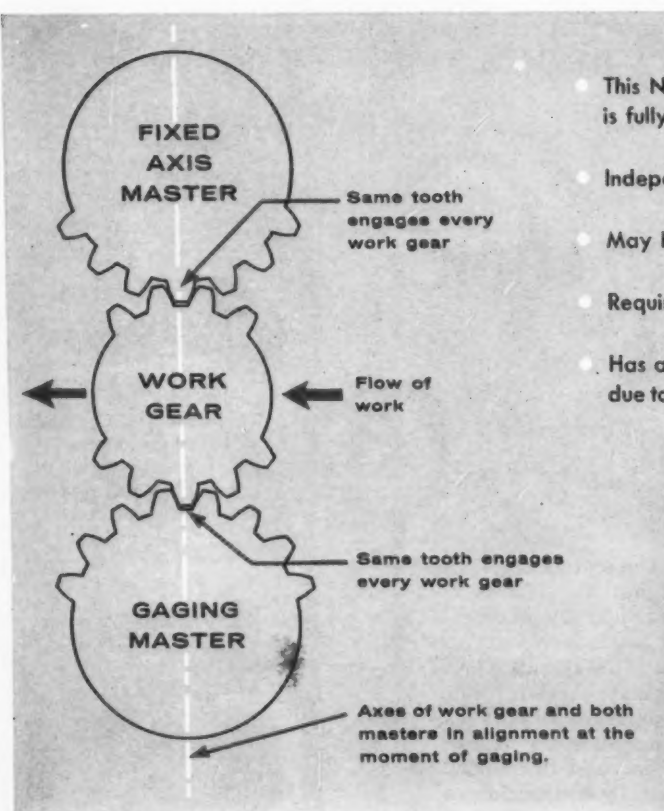
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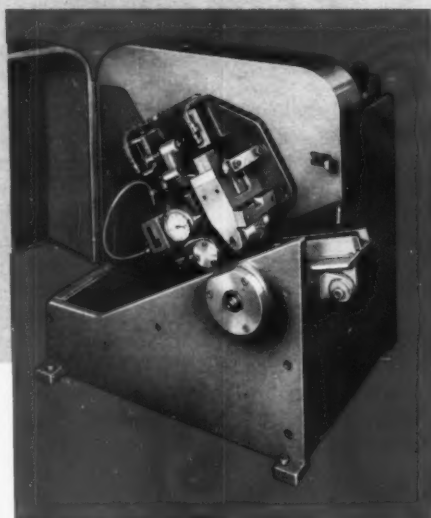
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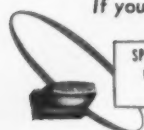
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- Special Type Incentive Needed Now
- Long-Range Efforts Continue
- Civil Defense Chief's Views
- Navy Closes Historic Plant



Keeping up with Washington

Loring F. Overman

ENCOURAGED by the Administration's announced interest in priming the pumps of capital investment through tax adjustments and depreciation allowances, the Machinery and Allied Products Institute announced itself in favor of three types of programs.

One is concerned with short-range action designed to deal specifically with present recession conditions.

Another restates the institute's long-standing recommendations, advanced over the years, favoring basic depreciation and other tax reform.

The third position of the institute is that private investment abroad is "a positive factor in domestic employment, the United States' balance-of-payments position, and the economy as a whole."

Special Type Incentive Needed Now

The short-range program favored by MAPI is intended to assist in attaining a three-point objective which, the Administration has stated, "should have a dynamic and immediate effect upon the improvement of our industrial base; should maximize the investment impact of every dollar of tax loss; and should have a countercyclical effect in the light of present recession conditions."

MAPI's program emphasizes the following points:

1. The need for a bold and major program rather than a limited or token effort to provide a real stimulus for the economy;
2. The widely different circumstances in which companies find themselves should be recognized—big versus small, expansion versus modernization requirements, etc.;
3. The program should be announced promptly and its retroactive application emphasized so that investment decisions will not be held in abeyance;
4. One proposal—the so-called Task Force approach (a tax credit equal to a specified percentage of the excess of a company's capital expenditures over its depreciation accruals)—involves certain disadvantages.

MAPI explains that "to limit the investment credit to that portion of capital outlays in excess of depreciation accruals will concentrate the benefit in rapidly growing industries and companies. For example, public utilities such as electric power, gas, and telephone, which normally overspend their depreciation by a wide margin in response to growth requirements, will have high eligibility under the Task Force program. Other industries with limited expansion needs will get little."

"It is not clear," the MAPI program continues, "why capacity expansion should be singled out for incentive,

rather than *modernization* and *improvement*. Our economy has relatively little difficulty in financing the expansion of capacity in growing markets. The real difficulty is in the modernization of existing capacity. This problem goes across the board.

"The real objective is to retool American industry, and a major contribution in this effort must be made by companies which are spending below their present depreciation accruals. Under the Task Force proposals, these might not be induced to spend any more."

Long-Range Efforts Continue

The institute's statement of position points out that for many years it has stressed the fact that "we do not have fully realistic depreciation because of the erosion of the purchasing power of the allowances from inflation. We have estimated that present underdepreciation runs in excess of \$5,000,000,000 per year. Thus, any new program in the field of incentive for investment will have a twofold purpose. It will attempt to bridge the gap between the present depreciation system and realistic recovery, and offer an incentive in order to obtain a bold and sudden improvement in our industrial base and productivity.

"The incentive factor is necessary and perhaps overriding in its importance, but we are also attempting to restore realism to our depreciation system."

Civil Defense Chief's Views

Renewed emphasis on industrial mobilization and emergency stabilization planning is forecast by Frank B. Ellis, new director of Civil Defense Mobilization. Director Ellis pointed out that present planning is completely inadequate, being pointed toward the eventuality of all-out nuclear war, rather than on the need to stockpile defense industry capacity for a possible extended emergency.

Navy Closes Historic Plant

Navy's decision to close the historic Washington Naval Weapons plant—once burned by President Madison to keep it from falling into the hands of the British—suggests other changes in Navy production policies. Industry has been told by Vice-Admiral George F. Beardsley, chief of Naval Materiel, that Navy is updating its machine tools with newer excess and idle equipment. "It is questionable," he said, "whether we should update government-owned tools at a contractor's plant. Replacing such tools militates against the Government's ever getting out of business." He suggested that business must find its own money to keep facilities modern.

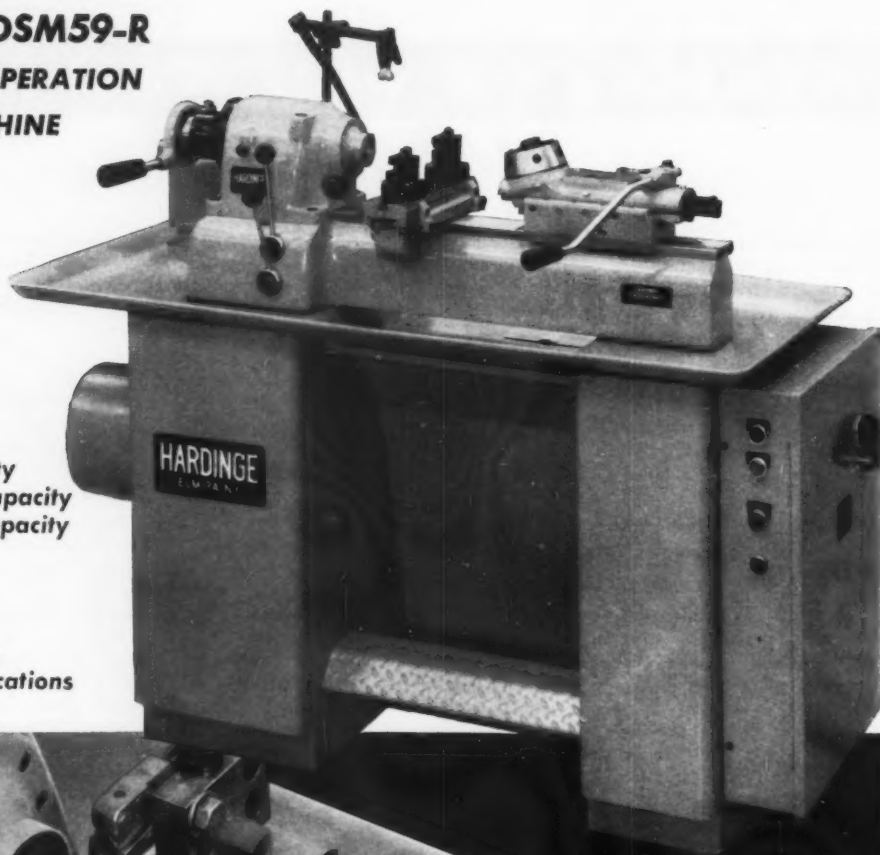
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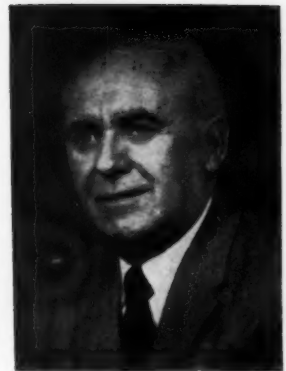


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RELIABILITY—that comparatively new term being increasingly adopted by branches of the metalworking industry—usually refers to the likelihood of non-failure in the performance of an assembly component. At first, many engineers looked upon reliability programs as a fad or fetish of scientists that would one day be relegated to the same limbo as “technocracy.”

Reliability is here to stay—make no mistake about that! It is absolutely essential in the fields of electronics and missiles and anywhere else that large numbers of intricate parts are combined in complex assemblies.

Let's say that a part has a reliability of 99 per cent. This means that past experience with the part indicates proper functioning 99 times out of 100—in other words, 1 failure out of 100 times the part was operated. Assemble that part with 399 other components possessing the same degree of reliability to obtain a mechanism with 400 working parts. The reliability of this assembly would be 0.99 to the four-hundredth power, or an unacceptable 2 per cent.

Consider now the fact that an Atlas intercontinental ballistic missile has 300,000 separate components. Assuming that all of these parts are of vital importance to satisfactory flight, they must all have a reliability of 99.99996 per cent if Atlas missiles are to reach their target nine times out of ten. It has been pointed out that if the Atlas 300,000 parts had a reliability of 99 44/100 per cent—the claimed purity of Ivory soap—not a single missile would ever reach its mark.

If the lay public understood the nature of missile and satellite requirements, it would not be critical of flight failures. Rather it would marvel that any missile could be put into successful flight.

Reliability programs have been so successful in the missile industry, it is no wonder that they have now been established also for more prosaic things like automobiles and other products which embody mechanisms. No question about it—reliability with its new concepts of quality control is here to stay.

Charles O. Herb

EDITOR



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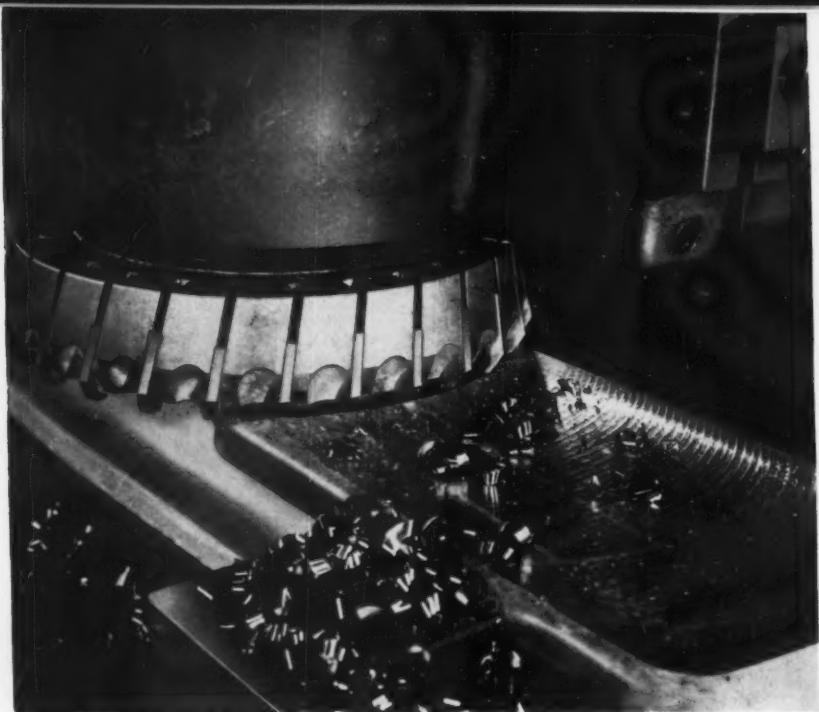
May 1961

When to Use Inserted-blade or Throw-away Milling Cutters

A manufacturer of both types of cutters takes an unbiased look at some new factors which must be weighed in making a conscientious choice of milling-cutter styles for today's rugged stock removal

FRANK GABLE, Chief Engineer
Wesson Co., Ferndale, Mich.

Fig. 1. When this operation was tooled, inserted-blade cutters were the best available. If a similar operation were to be tooled today, a complete cost study might favor throw-aways.



BECAUSE THE MAJORITY of milling operations can be performed by either grindable inserted-blade cutters or throw-away cutters, a study was made by the Wesson Co., Ferndale, Mich., of current industry practices to determine the factors that dictate the choice of one style cutter over the other for a particular application. A broad sample of industry was surveyed to determine industry's thinking, and application reports of the company's field-service organization were studied to obtain details of typical operations. The company makes both inserted-blade and throw-away styles of cutters. Thus, an impartial survey could be made and reported.

Of the plants surveyed, 95 per cent use throw-away insert face-milling cutters for either or both finishing and roughing. Up to now, most throw-away cutters have been used for roughing cuts. Further, no company of those surveyed, as yet, uses throw-aways for more than half its rough-milling operations. In other words, inserted-blade cutters are currently more widely used in industry than throw-aways.

Most plants, however, have a strong interest in throw-away milling operations. The average plant that uses any throw-aways tends to tool more and more operations with them each year.

It was found, through the survey, that selection of milling cutters is a matter of weighing a considerable number of factors. Many of these are interrelated. In addition, these factors do not have fixed values. As the values change, the decision in favor of one type of cutter or the other may be altered. As experience with both types of

cutters continues to increase—particularly with the newer throw-aways—late cutter developments and usage may radically alter the relative results to be expected under like circumstances. Furthermore, accepted tool economics alone do not furnish the complete basis for selection, although many of the important factors can be compared through the common denominator of cost.

The true test of a cutter selected for a particular application is: Will it meet *all* the requirements (accuracy, finish, and speed) of the operation, while resulting in maximum over-all production economies? Within this frame of reference, it can be seen that no isolated characteristic—tool life, tool cost, or other single parameter—is broad enough to serve as the basis for selection, although there have been occasions when one or the other of these factors has been regarded as the only criterion.

Metal-Removal Rate

There is no basic difference between the "chip productivity" potential of inserted-blade (Fig. 1) and throw-away insert milling cutters with the same number of blades and operating at the same surface speed. Throw-away inserts, in properly designed cutters, can carry just as heavy a chip load per tooth as inserted blades in conventional cutters.

However, where parts are thin-walled or where, for other reasons, a lower chip load per tooth is desirable to minimize cutting pressures (and possible part distortion), inserted-blade cutters

Fig. 2. Throw-aways broke through into finish milling when a cutter body was designed so that individual inserts could be adjusted. In this cutter, a cam-pin supports the insert:

have the advantage of longer face-cutting edges and offer the possibility of exposing more teeth per inch of cutter diameter. This feature permits reduction in chip load per tooth and, therefore, reduces cutting pressure on the part. Inserted-blade cutters, consequently, may also have a higher potential feed and metal-removal rate. The advantages of inserted-blade cutters, because of their larger numbers of blades, have been considerably reduced within the last year by the introduction of new developments in throw-away cutter-body design.

On the other hand, packing the maximum possible number of teeth in a cutter is not necessarily sound practice. Limited machine power and the characteristics of the operation may necessitate the use of fewer blades.

Metal-removal rate is just one characteristic of the milling process. Thus the best speed, feed, and depth-of-cut combination frequently results in a cutter having fewer than the maximum pos-

sible number of teeth, but which at the same time gives the most economical over-all production.

Surface Finish

Until recently, inserted-blade milling cutters had a major advantage over throw-aways in their ability to produce fine finishes. This is why most throw-away cutters now being used by industry are in roughing operations. The longer available length of the face-cutting edge and the greater number of blades for a given inserted-blade cutter diameter gave this design an inherent technical advantage in finishing. In addition, until recently, the accuracy of a throw-away cutter was limited to the commercial tolerances to which inserts were produced. Several recent developments, however, have greatly enhanced throw-aways for finishing cuts.

Since more accurate (and thus more costly) cutter bodies do not necessarily improve the finish obtainable with throw-away milling cutters, the next step has been an entirely new design, Fig. 2. In this cutter, a pin with a 0.030-inch rise cam is used to support the insert axially. Individual inserts can now be adjusted to stay within any cutter runout limits that may be required. The result is that surface finishes of 60 to 100 micro-inches (covering the bulk of industry finish-milling requirements) can now be achieved

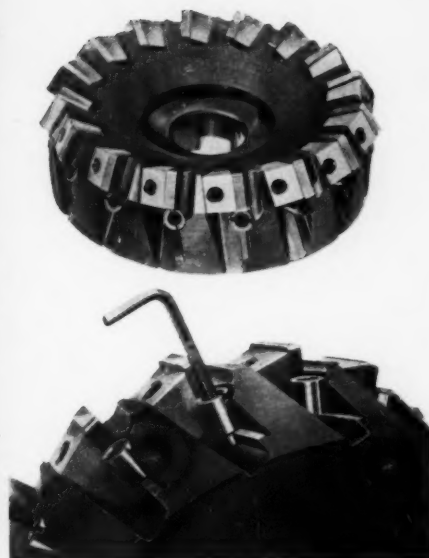
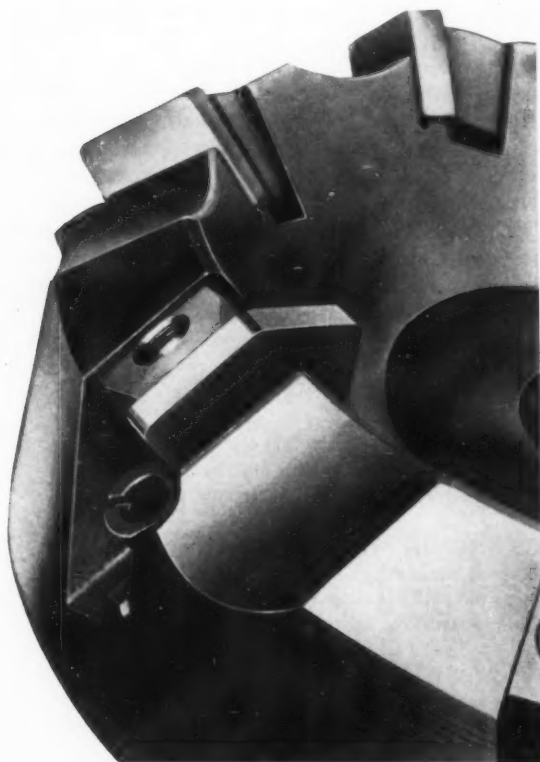


Fig. 3. An important development in throw-aways is the microfinishing insert which permits fine finishes at relatively high feed rates.



by throw-aways with routine setup procedures. Even better finishes are feasible if a little extra care is exercised in setup.

Immediately following this development in cutter bodies came another that further improves surfaces finish-milled with throw-away insert cutters. By replacing one standing insert in one of the new cam-pin cutters with a microfinishing insert, Fig. 3, surface finishes below 50 micro-inches are consistently obtained. This insert acts like a wiper blade and is precisely adjusted by the cam-pin in the cutter-body slot. In addition to removing feed marks, the microfinishing insert compensates for spindle misalignment. This occurs because the cutting edge of the microfinish insert is longer than the distance the cutter advances per revolution.

Nevertheless, inserted-blade cutters still retain an advantage for fine finish milling in many applications because of the greater number of blades that can be used in them. Their longer face-cutting edges also tend to permit a higher feed rate for an equivalent surface finish.

Before a final decision is made, however, non-tool-design factors—setup, grinding and handling costs, and burden factors—should be investigated.

Grinding Time and Cost

If a plant were just starting to equip for milling, there would be little question as to which type cutter design would be favored from a total tool-cost-per-piece standpoint. Other things being equal, adoption of throw-away cutters avoids much costly grinding-department overhead, equipment, and personnel. Not to be overlooked, either, are the costs of floor space, grinding wheels, and capital tied up in equipment for cutter grinding.

Even if the setup time for a throw-away milling cutter should equal the total grind-setup time for a conventional cutter on the same job, there would still be a direct, measurable saving in

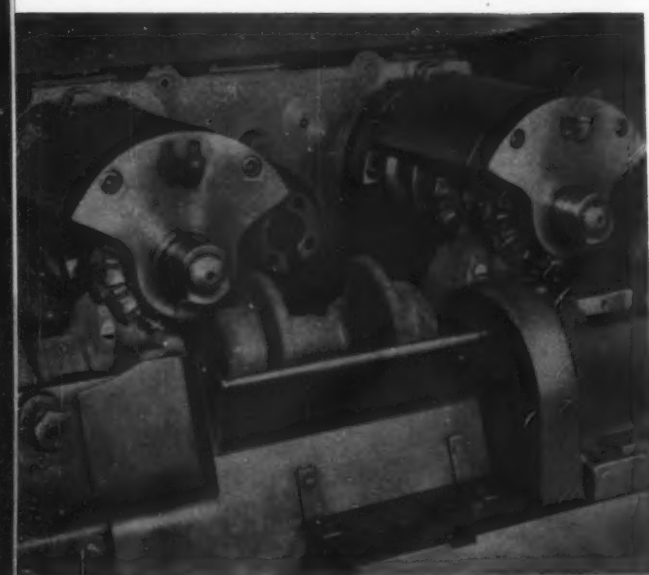


Fig. 4. (Top) Throw-away bits are increasingly indexed or changed on or near machine. This avoids unnecessary handling in cutter maintenance.

Fig. 5. (Center) Where equipment is available, it is often economical to lap used single-point inserts once. They are then used in milling or other operations to reduce insert cost.

Fig. 6. (Left) Inserts in this multiple-cutter crankshaft setup are indexed on the machine. In the first year of operation, savings exceeded the cost of the entire cutter setup.



Fig. 7. Use of threaded milling-cutter adapters can reduce setup costs for inserted-blade cutters both in the grinding room and on the machine.

grinding-wheel costs. Time is not the only criterion, because pay rates for different job classifications can influence the cost. In-plant practices for handling and setup may materially affect the over-all cost of milling with different types of cutters. With inserted-blade types, basic setup, in most companies, is done in the cutter-grind department. With throw-aways the trend is for the operator to make his own setup at or near the machine, Fig. 4, with consequent reductions in handling and floor-space costs.

It is a good idea, therefore, to analyze the load in the cutter-grind department before selecting milling cutters for new operations. Such departments usually are heavily loaded. The selection of throw-away cutters for a series of operations may be the difference between reducing the load and hiring more skilled grinding-machine operators—or even farming out (and losing effective control of) cutter grinding—to maintain the status quo in the department.

In plants where the equipment is already available, it is sometimes the practice to lap throw-away inserts after all cutting edges have been used, Fig. 5. Lapped inserts can be used again

in milling cutters or for other metalworking operations. It is highly doubtful, however, that the savings introduced by this practice justify capital investment in such lapping equipment in view of the low cost of new inserts.

Cutter and Blade Inventory

Throw-away cutters present a substantial cost advantage when it comes to cutter-body, blade, and insert inventory needs. Experience has demonstrated that the backlog of cutters, per job, can be reduced from four or five inserted-blade cutters to only two when throw-aways are used. This happens because there is no lead-time allowance for grinding time, and cutter "maintenance" is handled close to the point of use.

The inventory cost for throw-aways can be substantially less than that for inserted blades, since the same bank of inserts can also serve as backlog for both turning and boring operations.

Know-How

An important factor in cutter selection is the degree of familiarity with cutters by the people who work with them. This one factor of simplification sometimes overrules all others. Some com-

panies will do almost anything rather than live with two different standards, which would be the case if both throw-aways and inserted-blade cutters were used side by side.

Unhappy experiences with early throw-away cutters for finishing prevented many companies from using throw-aways, even where they were subsequently demonstrated to be superior. Now that finishing can be done easily with throw-aways, some of these same disillusioned companies are moving toward conversion of all their milling cutters to throw-aways. Certain firms seemed to reject the concept of stocking and maintaining two different types of cutters, in spite of demonstrable savings.

Setup Time and Cost

The latest types of throw-away cutters now appear to have definite advantages over inserted-blade types with respect to setup time and cost. This is true not only for roughing, where time savings can be impressive, but also for finishing operations, where a time reduction of 40 to 60 per cent is not unusual. The new cutter bodies have proved that it is now relatively easy to set throw-aways to achieve runout and surface finishes that equal the performance of inserted-blade cutters.

For roughing or semifinish milling, many plants (particularly the medium to large units) now index or change throw-aways directly on the machine. When this can be done, it avoids the down time normally required for spindle adjustment with inserted-blade cutters and all time and costs associated with removing or replacing insert blades. In other cases, indexing is done off the machine but adjacent to it, Fig. 4, thus avoiding transporting it back and forth to some other area.

On gang setups, where locations of the cutting edges are interrelated to establish part dimensions, time savings increase in geometric progression when throw-away inserts can be indexed on the machine.

In a typical precision operation, Fig. 6, brazed inserted blades were plagued by high grinding and setup costs, and an excessive number of broken blades in service. After switching to throw-aways, grinding costs dropped to zero, setup costs were drastically reduced, and production per set of cutting edges doubled, in all probability because of the absence of incipient grinding cracks that originated during brazing. This manufacturer of crankshafts spent about \$4000 for twelve throw-away cutter bodies, but his actual saving in tool costs and grinding time, and the increased number of pieces obtained per cutting edge (for only the first year on 170,011 crankshafts) was \$6093.99.

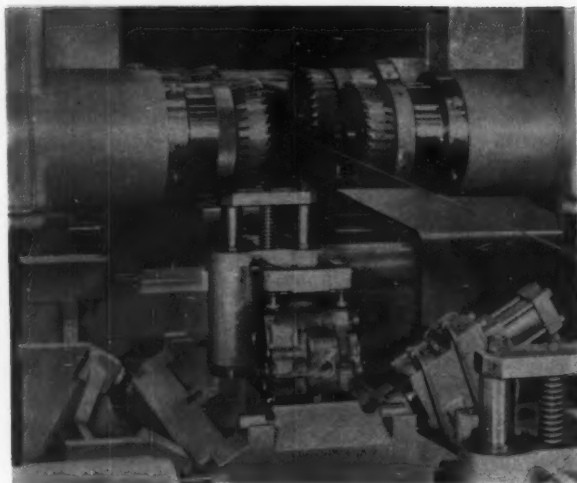


Fig. 8. These cutters are independently mounted in this transfer machine, but each spindle has to be adjusted to accurately set the over-all length of the work-piece. Adapters make setting a simple operation.



Fig. 9. With the hardened-steel wedge located behind the insert, damage during a smashup is minimized. In this wreck, the cutter body was not harmed, even though parts of insert and wedge were carried away.

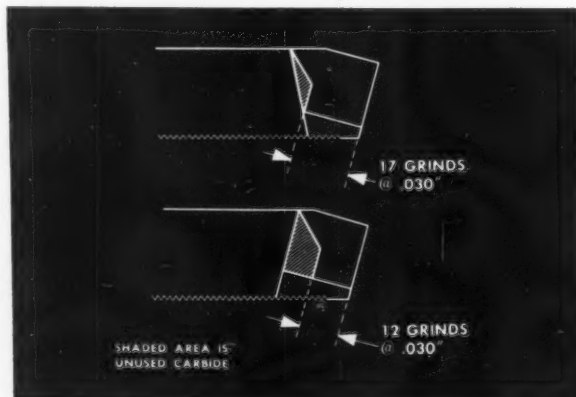


Fig. 10. More grinds for each insert blade are possible with a new inserted-blade design (above), which reduces carbide waste. The old design is shown below.

Considerable reduction in setup time can also be achieved with inserted-blade cutters, however, if quick-change adapters, Fig. 7, are used. With such adapters, up to four sharpenings of the blades are possible on face-milling cutters before blades have to be reset (assuming a normal blade wear of 0.020 inch per grind). Such adapters trim setup time when reconditioning cutters in the tool-grinding department, and they also save setup time at the machine. They avoid down time for spindle adjustment, which can be an important factor in keeping older machines running profitably.

Quick-change adapters are now being applied successfully to many mechanized milling operations, where they reduce setup time and increase product precision. In a typical example, Fig. 8, over-all length of the work-piece is established within dimensional tolerances of ± 0.0039 inch by milling cutters that feed inward independently from opposite sides. Here axial stroke is more rapidly adjusted in the adapter than in the hydraulic feed unit. When a new milling machine is being contemplated, the wisdom of using milling-cutter adapters for longitudinal adjustment should be seriously considered. The cost of the machine can be reduced if adjustment type spindles are not specified.

Scrap Loss

If they have correct geometry and are properly set up, inserted-blade and throw-away insert milling cutters will show little difference in their comparative scrap rates. However, because throw-aways are now so much easier to set up than formerly, tryout scrap, produced during setup runs, is minimized. According to the survey, throw-aways are now superior to inserted-blade cutters in this regard because they can be adjusted on the machine.

A significant cost in milling operations is that involved in the treatment of cutters during use, maintenance, and storage. In this area, losses vary widely, depending on the type of cutter and care given in grinding. With inserted-blade cutters, rejects will be produced if blades are not correctly ground—either through improper tool dimensions or carelessness leading to incipient cracks in the edge. Here, the major costs are in regrinding or replacement of the blades, plus tearing down and replacing the setup.

Obviously, throw-away inserts cannot be sharpened incorrectly because they are not sharpened. Also, it is difficult to clamp the wrong inserts in a cutter pocket. Thus scrap losses from these causes are nil.

Scrap may also result from accidents caused by cutter fracture traced to brazing strains de-

veloped in carbide-tipped blades or solid tipped cutters. This source of failure, however, is increasingly rare because tool manufacturers have begun to use semiautomatic heating for brazing. For this reason, it is a good idea to know something about the manufacturing methods used by individual blade and cutter suppliers.

Throw-away cutters are not subject to brazing problems, but they, like all cutters, are not immune to smashups. Here, cutter design can influence the amount of damage. When a hardened wedge can be located behind the insert, Fig. 9, it acts to protect the cutter body even though a portion of the insert is carried away in the wreck.

Tool Life

For the same grade of carbide, there is little difference in the number of pieces that can be milled by a set of cutting edges, whether they are applied as inserted blades or throw-away inserts. However, the economics of the carbide used in the two different types of cutter is more complex than a simple comparison of blade and throw-away insert costs.

If, by sound cost accounting, tool life is translated into tool cost per piece, the throw-away cutter with negative rakes has been proved to show a substantial life advantage. It is true that a brazed blade has a longer total life because it can be ground to more "new" cutting edges than either insert type. This contrast is amplified if blades with better utilization of carbide and more grinds—such as the one at top, Fig. 10—are used. It is necessary, however, to include in the cost of the inserted blade the cost of regular sharpening and also an added cost in the larger inventory of blades that must be maintained.

Throw-away insert cutters with positive rake have relatively shorter lives because only 50 per cent or less of the cutting edges can be used. A similar reduction in total insert life can also occur with cutters using nonsymmetrical insert shapes. Nevertheless, excluding instances where incorrect tool geometry, poor cutting conditions, or off-specification carbide grades have been used, carefully supervised in-plant cutter tests have brought to light a surprisingly large number of applications where longer life per cutting edge results from a change-over to throw-aways.

Effect of the Machine

The effects of a given milling machine's age and condition on the selection of cutter types are inconclusive. Either type of cutter (with a negative rake) has a tendency to compensate for backlash, and other results of wear or obsolescence in the equipment, and thus provide a



Check List

Factors that Should Be Weighed in Choosing Between Inserted-Blade and Throw-Away Milling Cutters

- Metal-removal rate
- Finish required
- Grinding time and cost
- Setup time and cost
- Cutter inventory requirements
- Scrap costs
- Tool life
- Condition of milling equipment
- Tool-geometry factors
- Initial cutter cost
- Labor relations
- Capital costs
- Testing facilities
- Material to be machined
- Part design
- Availability of cutter designs
- Cutters already in use in plant
- Cutter maintenance cost

steadier cut. But negative rake requires more power (which may be lacking in an old machine). The greater mass of an inserted-blade cutter has one advantage for some applications on older or worn machines. Its flywheel effect helps to dampen vibrations generated in the machine. The greater mass may or may not be an advantage at the higher cutter speeds used to mill aluminum. If the cutter is mounted on center but is not balanced, the same amount (not percentage) of imbalance can have less effect on a heavier cutter. Where spindle misalignment is pronounced, the long face-cutting edge of inserted blades removes the effect of eccentricity to produce passable finishes. The use of wiper blades in the newer throw-away cutters achieves similar results.

Tool Geometry

Throw-away cutters will mill with the same efficiency as inserted-blade cutters, once the most effective blade geometry is known for a specific

job. There has been a widespread belief that only double-negative rake angles can be used with throw-away milling cutters. Tests on actual production parts have shown that double-positive and combination positive-negative rake angles can be used effectively to direct chip flow and avoid excessive cutting pressures on piece-parts or fixtures. A good guide to milling-cutter selection is: Do not switch to throw-away cutters unless you have either previously determined tool geometry on an almost identical job or else have the counsel of an experienced cutting-tool engineer who has tool-geometry data available.

If the operation is out of the ordinary, correct tool geometry can be determined more readily with inserted-blade cutters. These permit experimentally grinding various angles until the best geometry is proved. An alternative is the cartridge type cutter. By trying standard throw-away cartridges (90, 5, 15, 30, and 45 degrees) the optimum angle can be determined. Cartridge type cutters are more expensive, but they can be used indefinitely for test purposes. Thus they repay their cost in speed and convenience. Their advantage over inserted-blade cutters is that lead time between tests is shortened, and no grinding is required (which is especially important for the company that does not have a cutter-grind department). Of the companies now using throw-aways, about half introduce new cutters as retooling. Other plants use inserted-blade or cartridge type cutters just to establish tool geometry for throw-aways. Then the tryout cutter is free to be used for other experiments.

Initial Cost

In general, the initial cost of cutters is a relatively minor factor in determining over-all economic advantages. Throw-away insert cutter bodies tend to be somewhat more costly, at present, than bodies for inserted-blade cutters. But, because fewer cutter bodies are required per operation, the over-all cost may not be as great. When weighing the factor of "initial cutter cost," the far more important burden-cost factors implicit in each type of cutter should be paramount.

Labor Factors

While not entering directly into tool economics, labor factors are important when selecting cutters. Weighing heavily is the effect of the selection on tool grinders and machine operators. Selection of throw-aways and transfer of indexing and presetting functions to the production area can do much to relieve an overworked cutter-grind department without adding skilled grinding-machine operators. When a complete shift

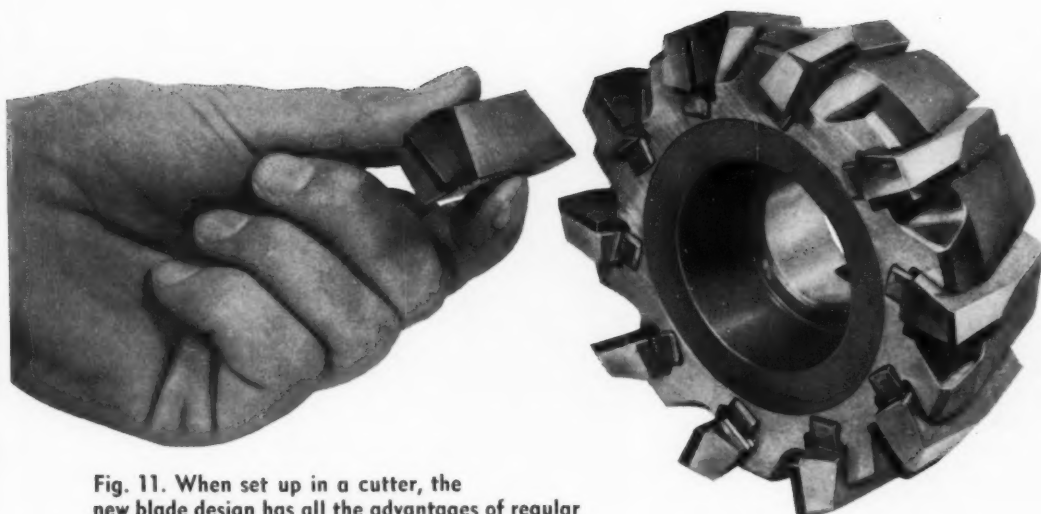


Fig. 11. When set up in a cutter, the new blade design has all the advantages of regular inserted-blade cutters plus the advantage of better carbide economy.

from inserted-blade to throw-away cutters is contemplated, the possible effect on the attitude of the labor force toward a sudden realignment of maintenance responsibility should be considered in advance.

If cutters are to be maintained at the machine, it is necessary to train the operator in proper changing, indexing, and setup techniques. Such instruction does not take long. The most important detail is to impress the operator with the need for removal of all chips from insert pockets during both the indexing and the changing operations. It is also prudent to set up insert-indexing standards. When dull inserts are used so long as to fracture, one or more cutting edges on the reverse side may be ruined. Needless to add is that the work part will also be spoiled.

Available Cutter Designs

While the types of inserted-blade cutters available are rather well known, the throw-away is

still relatively new and thus the variety of bit styles already available are not as familiar.

It is good practice to determine whether a stock throw-away is available for a particular job when the matter of cutter selection is raised. The inserted-blade style cutter may be better for a given job, even though a throw-away is available, but this cannot always be assumed.

Summary

The thinking that should go into selection of a milling cutter is complex but it need not be difficult. In addition to borrowing the experiences of others, it is possible to guide the selection process, using a balance sheet or score card.

Each factor, properly converted into a dollar value, can be listed point for point for the various types of cutters being compared. When the converted factors are totaled they quickly show which style of cutter will result in the lowest over-all production cost.

Friction Welding

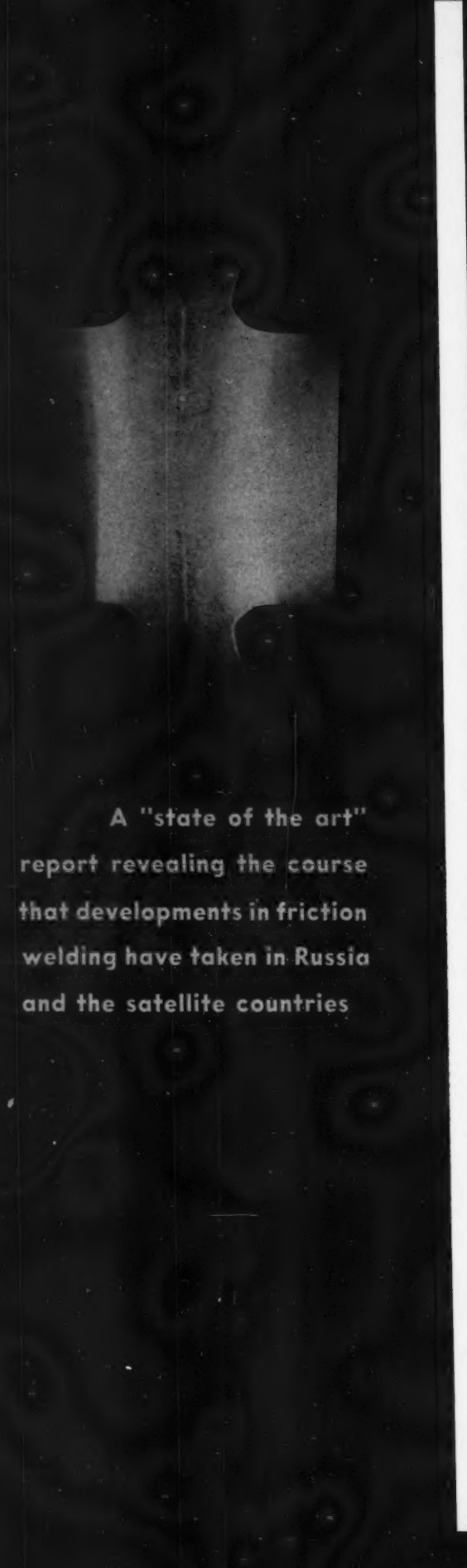
FRICTION WELDING is a form of pressure welding in which the mating faces of the two members to be joined are held in contact under pressure and rotated relative to each other. Although in the simplest arrangement one part is kept stationary, both may be rotated. Because of the friction, the metal in the joint faces is heated to a plastic condition and the welding pressure causes a certain amount of upsetting to take place. A macrophotograph of two friction-welded components is shown in Fig. 1. One characteristic of the process is that the heat generated is confined to a small area, and power consumption is claimed to be lower than that for other welding methods.

Use of the process is restricted to making joints in which at least one face is of circular or annular cross section. The other component, however, may be of any shape. Some examples of parts that can be joined by friction welding are shown in Fig. 2.

Changes in functional variables during a typical friction-welding operation is shown graphically in Fig. 3. After initial acceleration, the work speed is maintained constant, as indicated by Curve 3. Graph 4, showing the pressure between the two components, is representative of many friction-welding operations. For certain materials, however, a constant pressure may be applied, especially when parts of small cross section are being welded.

The Process Consists of Two Distinct Phases

The process can be subdivided into preheating and upsetting phases. At the start of the welding sequence, components are held in contact by applying a preheating pressure. After initial contact, the frictional moment increases until the work material becomes plastic. The maximum frictional moment (indicated by X, Fig. 3) depends on the preheating pressure and the diameter of the com-



A "state of the art" report revealing the course that developments in friction welding have taken in Russia and the satellite countries

Behind the Iron Curtain

Fig. 1. (Left) Macrophotograph of two components that have been joined by friction welding.

ponents, but is not appreciably influenced by the type of metal being welded.

As soon as the material becomes plastic, the frictional moment is reduced to a virtually constant value for the remainder of this phase of the process. There is, however, a slight tendency for the moment to decrease. When the welding temperature has been reached and sufficient material has been preheated, the upsetting pressure is applied (usually after a predetermined period of time). This is followed by a decrease in the frictional moment. Control instruments then switch off the power to the driving motor and stop the work-spindle. The sharp increase of frictional moment (indicated by Y in Fig. 3) toward the end of the sequence is caused by the decrease in speed and the formation of the weld. As may be seen from the graphs, the total time for the welding sequence is determined principally by the duration of the preheating phase, the upsetting time being only a fraction of that for preheating.

Factors that Influence Welding

The main factors which influence welding operations are speed of rotation, preheating pressure, upsetting pressure, and the period of time from the application of the upsetting pressure to the stopping of the work-spindle. In order to obtain consistently good welded joints, all phases of the welding cycle should be controlled.

The intensity of the heat generated at the contacting surfaces depends on the preheating pressure, the relative speed of rotation, and the physical properties of the metal (for example: coefficient of friction, thermal conductivity, and specific heat). Heat is not generated uniformly throughout the cross section of the joint, but

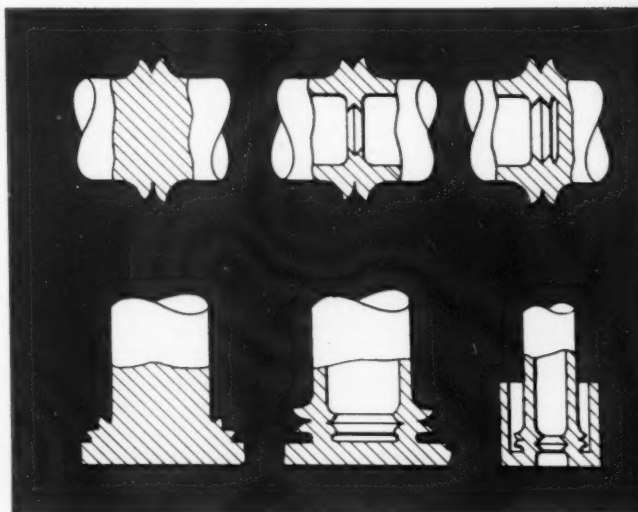


Fig. 2. Examples of composite work-pieces that have been produced by friction welding.

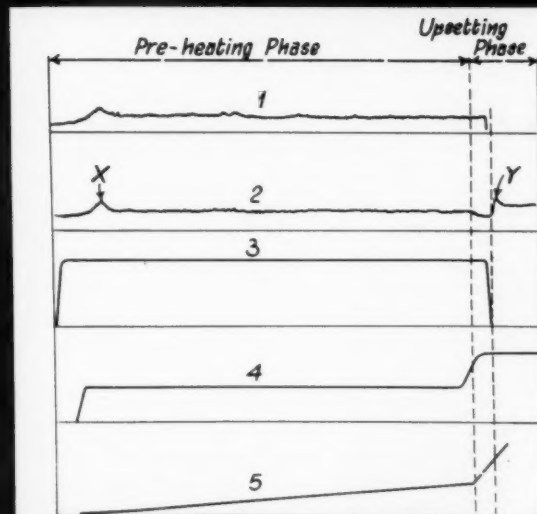


Fig. 3. Graphs of power consumption (1), friction moment (2), speed (3), pressure (4), and volume of upsetting (5) during welding cycle.

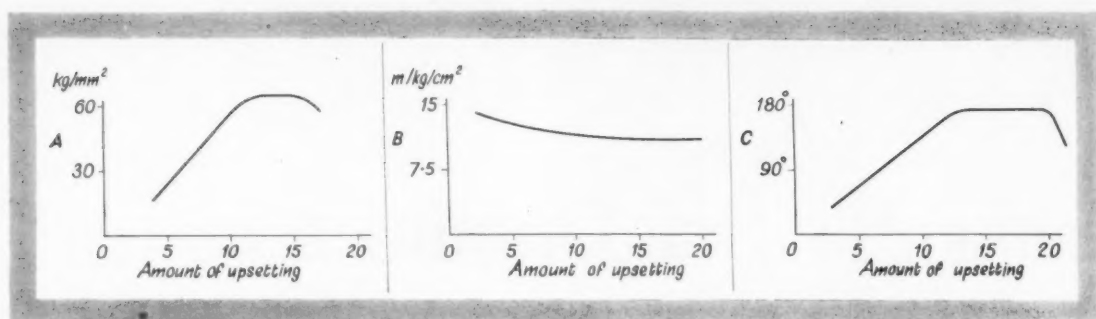


Fig. 4. Graph A shows how the amount of upsetting varies with tensile strength for a friction-welded joint made between high-speed and carbon steels. The relationship between amount of upsetting and notch strength (Graph B) and amount of upsetting versus bend strength (Graph C) are also given.

equalization of temperature occurs very shortly after the metal becomes plastic. Once in this condition, the metal in the heat-affected zone flows outward from the center, as seen in Fig. 1. The temperature in the direct vicinity of the weld, measured with an optical pyrometer, is approximately 1200 degrees C.

Investigations have shown that friction welding is initiated in the austenitic range of temperatures, and that the maximum temperature is not higher than the melting point of the metal. It can therefore be assumed that the theory of friction welding is closely related to that of cold- and hot-pressure welding.

Technology of Friction Welding

Research into friction welding has been carried out with pilot-plant equipment, for the purpose of obtaining data for the design of special welding machines and to determine the fundamental factors that influence weld quality. For the sake of simplicity, nonalloyed low- and high-carbon steels were selected for investigation of the influence of certain variables on quality.

Tests show that weld quality depends principally on two factors: temperature and pressure. The latter causes deformation whereby both mating surfaces are maintained in close contact to permit the interaction of atomic forces, and also imparts the desired mechanical properties to the weld. Conditions during both the preheating and upsetting phases have specific effects on weld quality.

In the preheating phase, a sufficient quantity of heat must be generated to bring a certain volume of material (necessary for a weld of the required standard) to the plastic state. Due to the high temperature required, primary grain growth

is apparent in all materials. Coarsening of the structure is especially noticeable in steels of high carbon content, which have a lower critical temperature of primary grain growth. From a comparison of grain sizes in samples preheated at 1100 and 1800 rpm, it was evident that the grain structure was much finer when the lower preheating speed was adopted.

The speed used during preheating also affects the process in various other ways. When the lower speed is employed, the plasticized metal is immediately extruded to form a flash. At the higher speed, only partial deformation occurs during the preheating phase. The material is heated to a greater depth and the upset is small. By the end of preheating, there has normally been considerable grain coarsening.

In the development of friction welding, one of the fundamental requirements was to reduce or eliminate grain coarsening. Tests demonstrated that this could be achieved by correct selection of variables in the upsetting phase. It is known that recrystallization of the metal can result from plastic deformation of the material when heated. The tests also show that recrystallization due to plastic deformation during friction welding can occur only if about 50 per cent of the over-all upset is caused by the upsetting pressure.

Plastic deformation as a result of the preheating pressure (which is an incidental effect of this phase) does not in any way improve weld quality. In order to achieve recrystallization due to plastic deformation during upsetting, provision must be made for adjustment of the ratio between the preheating and upsetting pressures over a wide range.

Maximum economy is obtained by a combination of pressures which will result in the shortest over-all welding time and optimum weld quality.

The criterion of quality used for the investigations was the 180-degree bending test. The magnitude of the upsetting pressure employed is approximately the same as for flash butt welding. This pressure primarily affects the notch toughness of the joint. Depth of the preheated zone is initially influenced by the magnitude of the preheating pressure. Since the amount of plastic deformation during the upsetting phase affects weld quality, the magnitude of the upsetting pressure is selected to suit the type of material being welded.

For joints that are not subjected to subsequent heat-treatment, the duration of the preheating and upsetting phases should be such as to insure adequate recrystallization of the material during upsetting. For joints that are heat-treated after welding, such provision is unnecessary. Higher preheating pressures can be applied, with the result that this phase is shortened, and the over-all welding-cycle time reduced. If necessary, a constant pressure can be used for both phases, provided subsequent heat-treatment is carried out.

Apart from its effect on the process, the speed

of work rotation has a significant influence on the design of friction-welding machines. Excessive strains are imposed on such equipment if large-diameter parts are welded at low speeds. This is especially true during the dry-friction period before the material becomes plastic. A speed of rotation must be selected that insures least possible strain on the machine and, at the same time, satisfies the technological requirements of the process. For work-pieces with diameters ranging from approximately 3/4 to 2 inches, the rotary speed should normally be about 1500 rpm.

The over-all amount of upsetting is of importance in friction welding. Over-all upsetting comprises the incidental upsetting caused during the preheating phase and that resulting from the second phase. For a given set of welding conditions, the amount of upsetting depends on the material. In the case of steels, over-all upsetting increases with the carbon content. For maximum weld quality, there is an optimum amount of upsetting, and if this amount is exceeded, lower quality results. There are characteristic relationships between the mechanical properties of the weld and the over-all upset (Fig. 4). These relationships vary for different combinations of materials. In the illustration, Graph A relates tensile strength to the amount of over-all upsetting for a friction-welded joint between high-speed and carbon

Fig. 5. A hydraulically operated friction-welding machine designed for automatic cycle control.

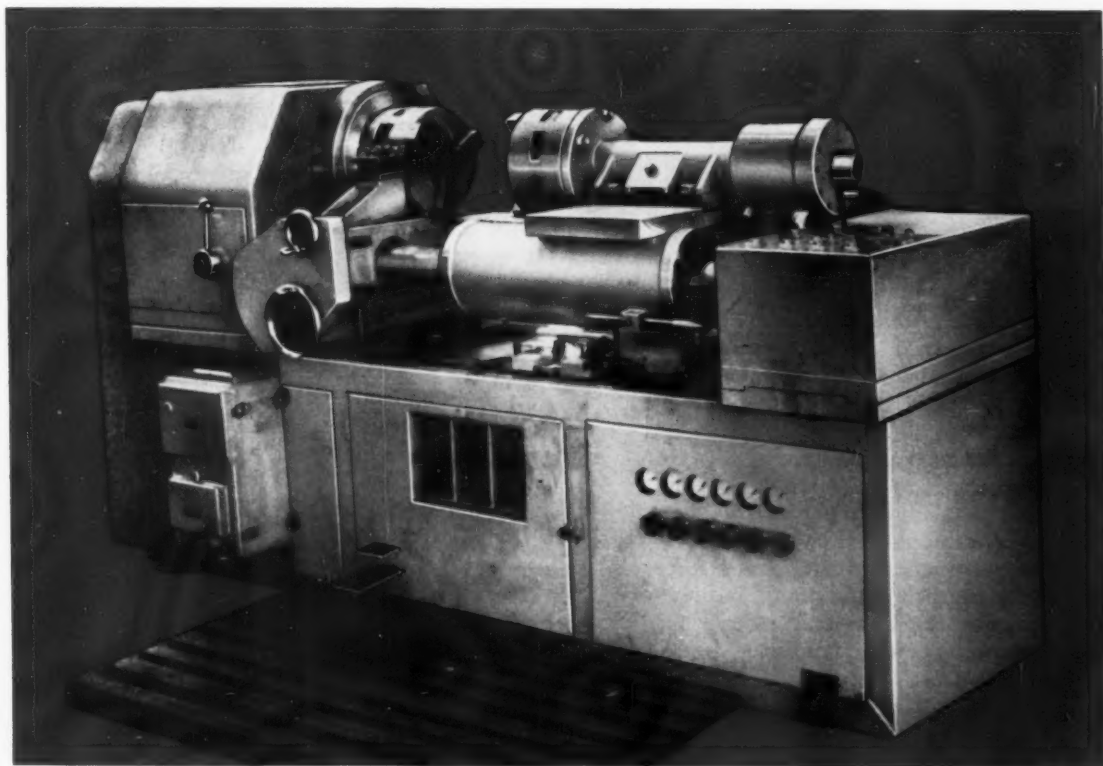
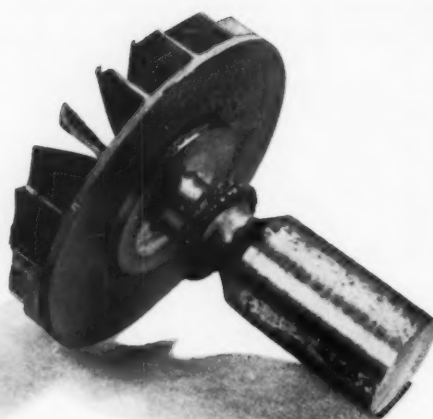


Fig. 6. An exhaust-gas turbine rotor assembly made with a friction-welded joint.



steels. Graph B shows how notch strength varies with the amount of upsetting for a joint in 18/8 chromium-nickel steel that has not been post-weld heat-treated. Graph C illustrates the relationship between bending angle and upsetting for a joint in the latter material.

Welding Different Materials

Nearly all steels (including low- and high-alloy and carbon types), aluminum, copper, bronze, brass, and titanium can be friction-welded. The requirements for welding combinations of materials of basically different chemical composition are more complex than those for joining steels of approximately similar type. When joints are made in different materials of similar thermal conductivity, including highly alloyed materials, a good weld can be readily achieved because the two work-pieces are uniformly heated. Greater difficulty is experienced when welding materials of different thermal conductivity. A typical example is the joining of parts of high-speed steel to those of carbon steel.

To obtain good-quality welds, the work-piece cross sections in the vicinity of the contact surfaces must be such as to insure equal heat flow in both. For example, when welding cylindrical studs to flat plates without seating recesses, the cross section of the studs must be greater than the thickness of the plates in order to achieve thermal equilibrium and prevent excessive heat flow to the plates.

The joint faces of parts to be friction-welded need not be clean or accurately flat. No machining is necessary on components that have been

sawed from bar stock, and welding can be carried out even when grease, rust, or scale is present on the faces.

Machines for Friction Welding

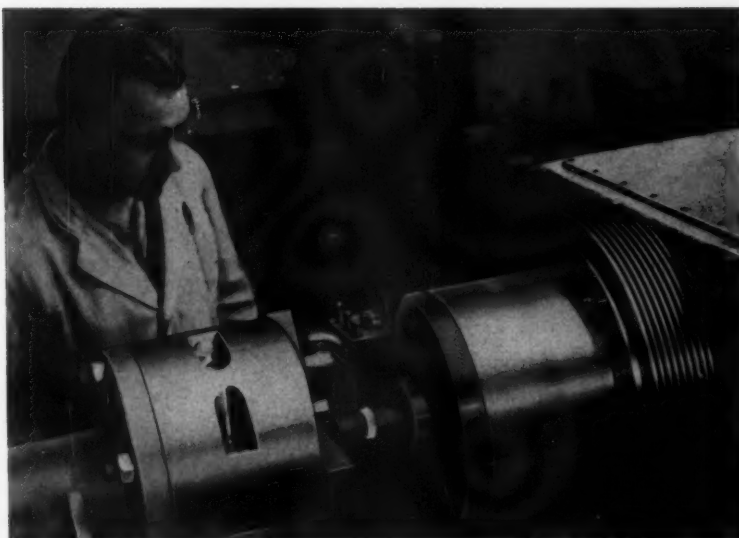
Originally, the process was carried out on various types of lathes, and can be done with any suitably modified machine tool of this type. Reliable and economic friction welding can only be done, however, on specially designed machines which combine the characteristics of single-purpose lathes and rigid presses. In addition, automatic control should be provided.

The prototype friction-welding machine seen in Fig. 5 is suitable for welding components in steel and nonferrous metals which have cross-sectional areas ranging from approximately 0.5 to 3 square inches. This machine, which was developed in Czechoslovakia, is designed for fully automatic operation. The application of upsetting pressure is controlled either by a timing unit or by the amount of deformation that takes place during the preheating phase of the cycle. A maximum pressure of 20 tons can be applied by the upsetting unit which is mounted at the right-hand end of the bed.

The headstock spindle is driven by a 33 1/2-hp motor. Hydraulic chucks for holding the work-pieces are mounted on the spindle and the upsetting unit. These chucks are automatically opened at the end of the welding cycle. The upsetting unit is then moved rapidly to the right for removing the welded components and loading fresh parts.

Work-pieces up to 8 inches long can be held

Fig. 7. Close-up view showing an operation in progress on a friction-welding machine of the type seen in Fig. 5.



in the headstock chuck, and parts of unlimited length can be gripped in the chuck of the upsetting unit. The machine can be used for welding high-speed steel and carbon-steel parts to form, for example, rotating cutting tools. Gear blanks and turbine rotors also can be welded to shafts. The exhaust-gas turbine rotor seen in Fig. 6 is a typical friction-welded assembly, and a friction-welding operation is shown in Fig. 7.

If required, the chuck on the upsetting unit can be readily removed, and can be replaced by a hydraulically operated vise or fixture. The headstock chuck can also be replaced by a fixture. A saddle and cross-slide, provided adjacent to the headstock, can be employed for machining the ends of the work-pieces in preparation for welding (if necessary) or for removing flash formed during the process.

Air-Lubricated Bearings Developed by Chrysler

Research engineers at the Chrysler Corporation Missile Division have developed two unique air-lubricated bearings that hold promise for a wide range of future military and space transportation applications. One bearing—a hydrodynamic, or rotating type, cylinder—generates its own air film when rotated at high speeds. The other, a hydrostatic bearing, is made from a special, porous, sintered powdered metal through which pressurized air is supplied to form a lubricating film. Their development is the result of an extensive three-year investigation into the air-lubrication field by the division's experimental laboratory, with the ultimate objectives aimed at low-cost, easily produced, good-performance bearings.

Design of the hydrodynamic bearing is based on the principle of self-induced air pressure resulting from high-speed rotation of the shaft within a cylinder. It carries the principle one step further, however, by containing a mechanical offset wedge which induces additional air be-

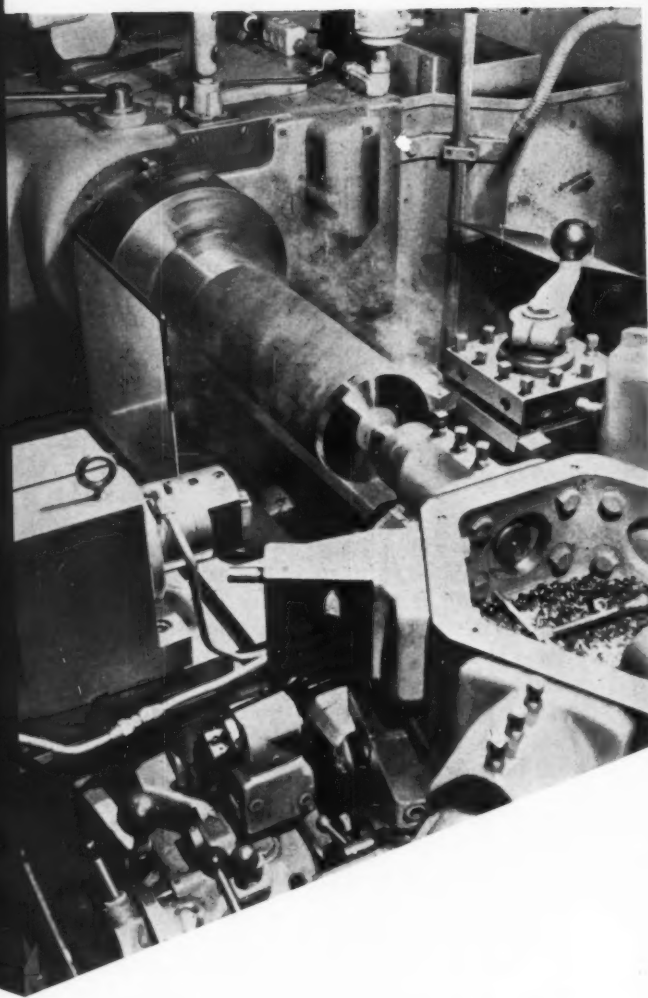
tween the metal surfaces during rotation. As a result, the surfaces never touch one another.

Elimination of metal-to-metal contact means almost unlimited life for the hydrodynamic air bearing and enables it to withstand operating temperatures ranging from minus 300 to plus 2500 degrees F. Temperature variance is limited only to the many different metals from which the bearing can be made.

The hydrostatic air bearing is made from the same material used in oil-impregnated Oilite bearings. In perfecting the hydrostatic bearing, oil was replaced by pressurized air that passes through the porous metal to form a lubricating film.

Air bearings have already shown a potential for use in navigation gyroscopes and other inertial guidance devices, turbines, military and space devices where high speeds and high temperatures restrict the use of standard lubricants, and in nuclear power plants where radiation quickly destroys conventional lubricants.

take a
good look
at



CERAMICS

Ceramic cutting tools have come a long way since World War II. Although they are not a panacea for all machining applications, and do display some inherent disadvantages, ceramic tools are being accepted because of their broad potential to multiply production and effect economies

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THE introduction of new materials, more difficult to machine than those in common use a quarter of a century ago, has accelerated the development of better cutting tools and improved machines. In the early 1930's, following the high-speed-steel tools, cemented carbides came into the picture and have contributed greatly to advancement in metal-cutting. It appears that the metalworking industry is once again on the threshold of a similar potential of advancement with cutting tools made of ceramics.

Ceramic tools now provide the means of more rapid and accurate metal-cutting than has heretofore been possible with conventional tools. They are reaching a status of practical use because of their potential to increase production, effect economies, and contribute to greater production efficiency.

This article will deal directly with the advances in development and application of ceramic cutting tools only. Cemented carbides, although of great importance and interest, are excluded as being a cermet rather than a ceramic.

What Are Ceramics and Cermets?

Use of the word "ceramic" with respect to a cutting tool is not sufficiently explicit, since the word already carries a meaning inconsistent with the properties normally thought to be required for cutting metals. To adequately visualize the subject, clarification is required of this word, along with the word "cermet," as applied to cutting tools and cutting tool types.

Ceramics—Ceramics may be defined as inorganic, nonmetallic materials which are processed by heat to form useful products. Ceramics include such materials as porcelains, abrasives, structural clay products, glass, refractories, and cements. They usually consist of oxides or combinations of oxides, or of materials such as carbides, nitrides, borides, and combinations of these. From this broad class of materials, aluminum oxide has a combination of properties which make it especially suited for cutting metals. These properties are its hardness, high melting point, strength, chemical stability, and thermal conductivity.

Cermets—Cermets are materials which are a combination of metal and ceramic. Metals may contain nonmetallic constituents, and ceramics may contain some metal. But a cermet is a material which contains both a ceramic phase and a metallic phase in substantial quantity. Examples of cermets are titanium or tungsten carbides bonded with cobalt and chromium-alumina combinations. Cemented-carbide tools used for metal turning are thus classified as cermets.

Some Background of Metal-Cutting Tools

To get the proper picture of present-day research in machining of metals with ceramic tools, it will be helpful to review a little of the history in the art of metal-cutting. Prior to the last quarter of the nineteenth century, all metal-cutting tools were made from straight carbon steel. Sometime during the last quarter of the century, hardenable tool steels were developed.

By the early 1900's high-speed steels had been developed in this country which allowed increased cutting speeds of the order of 4 to 1 over the standard tool steels. From this period to the 1930's when carbide cutting tools were introduced, progress was slow. With the advent of carbides, progress has been steady and continued to the present.

Concurrently with these developments, the possible use of aluminum oxide as a cutting-tool material for supplementing conventional carbides has received considerable attention. The earliest investigations appear to have been conducted in Germany in 1905, followed by patents issued in 1912 in Great Britain and in 1913 in Germany.

Further studies began in Germany in 1934 and continued to World War II, resulting in a ceramic-tool material that was produced on a development basis. A United States patent was issued on this material in 1942. Initial attempts to make ceramic cutting tools in the Soviet Union took place in 1943.

Although certain abrasive and refractories producers in the United States worked with ceramic cutting tools as early as 1935 for the machining of nonmetallics, it was not until about 1945 that serious consideration was given to the machining of metals and a program in metal-cutting with ceramic tools was instituted. Tests established that aluminum oxide would machine steel, but that the ceramic tool developed at that time did not perform as well as tungsten carbide under the conditions selected.

Recent Developments in the United States

It remained for Watertown Arsenal, cooperating with commercial companies in 1954, to uncover the unusual merits of ceramic tools that placed them in a competitive status with other types of metal-cutting tools. This program was aimed initially toward developing new materials and methods for the machining of metals using nonstrategic materials for cutting tools.

In this work, still underway at the Rodman Laboratory of Watertown Arsenal, certain newly developed tool compositions of alumina were successful in lathe-turning a variety of metals at considerably higher than conventional machining speeds. These ceramic tools are reported not to pick up heat, to exhibit less friction loss between the tool and chips, and to be more resistant to cratering than conventional tools.

It was also determined, however, that ceramic compositions require a different tool geometry, as well as more rigid machine and tool fixtures. Tool-holders of standard design did not, in general, provide adequate tool-bit support and re-

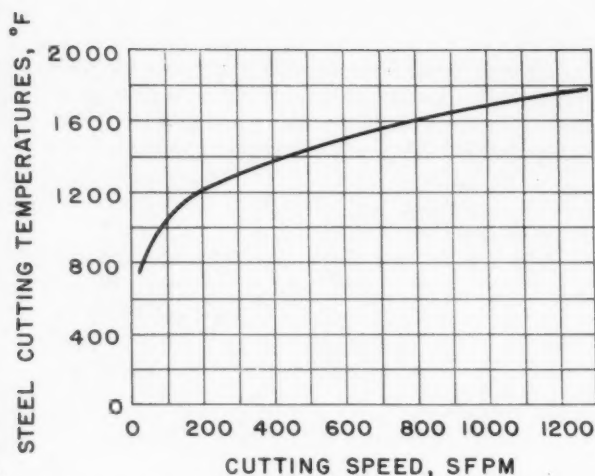


Fig. 1. Graph shows the relationship between cutting temperature of steel and cutting speed when using ceramic tools. Indications are that ceramic tools can withstand continued operation at temperatures in excess of 2000 degrees F.

sulted in premature tool failure. This work has provided much of the ever-increasing stimulus to develop superior ceramic tools in this country. It is probably safe to say that the more recent tools show increased performance of a 5-to-1 order of magnitude over the earlier tool introduced prior to 1956.

Properties of Ceramic Tools

Chemical Properties—The chemical properties of alumina place it in a unique position. Resistance to oxidation is one important characteristic of aluminum-oxide ceramic tools. Application of high temperature to aluminum oxide in air causes no detrimental chemical effect, as the material is already in the highest state of oxidation. This factor is important in modern-day metal-cutting practices where high-speed machining generates large quantities of heat, with prospect for even more speed and still higher heats in the future. Alumina tools have performed continuously with the cutting edge at red heat for prolonged periods of time.

Another advantageous chemical property of aluminum oxide is its low affinity for most metals. Therefore, it is not readily wetted, so that there is little tendency to load. A metal tool rubbing past the metal part tends to weld itself to the work-piece. This welding is promoted by the high pressures and high temperatures reached. Continued relative movement causes fracture of the weld joints, or pulling out of small particles, resulting in wear. Cratering of the top surfaces of metal tools as the chip passes over is apparently a result of similar action.

The tendency of aluminum oxide to weld to

steel is very low up to, and through, the melting-temperature range of steels. This allows machining of this material at the temperatures created by operating speeds much higher than heretofore thought possible. However, the low affinity between aluminum-oxide tools and the work-piece does not prevail for all metals. A scale of work-material compatibility with respect to use of ceramic tooling is given in Table 3.

The data presented in the table does not imply, for instance, that ceramic tools should not be used on aluminum, but merely that less efficiency would be attained than with steel. On the other hand, little success with the machining of titanium has been achieved up to now.

Physical Properties—Density, or specific gravity, of oxide tools is closely related to their method and uniformity of manufacture. Performance, in general, is in proportion to the density, other factors remaining constant.

Hardness, while one of the most important characteristics required in a cutting tool, is also the most difficult to define or measure. Numerous methods of measuring hardness at elevated temperatures have been employed, including adapted Rockwell and Vickers equipment. So far, no completely satisfactory system of testing the hardness of ceramic tools has been developed.

Nevertheless, sufficient data have been assembled to indicate the retention of stable hardness in ceramic tools to very high temperatures. It has also been shown that the degree of heating of the cutting edge of a tool is proportional to the speed of cutting, Fig. 1. For practical purposes it appears that an alumina ceramic tool can withstand continued operation in the range of 2200 degrees F.

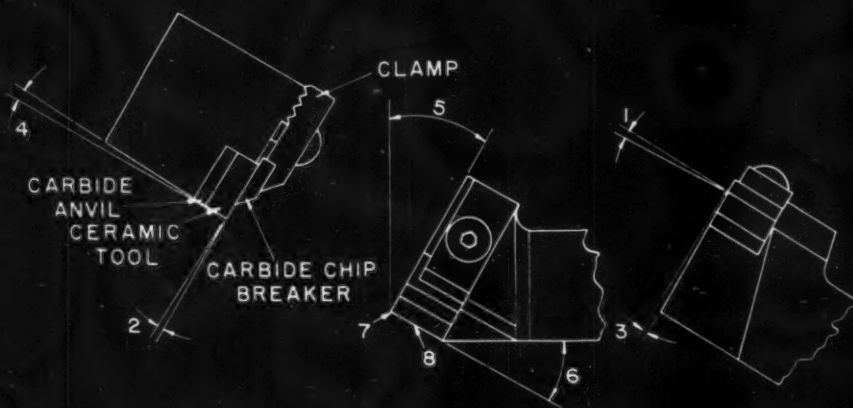


Fig. 2. Mechanical ceramic tool-holder. Key to tool-angle nomenclature: (1) back-rake angle; (2) side-rake angle; (3) end-relief angle; (4) side-relief angle; (5) end cutting-edge angle; (6) side cutting-edge angle; (7) nose radius; (8) cutting edge.

Unlike ductile metals which have tensile and compressive properties that are nearly the same, the tensile strength of ceramic tools is only about one-tenth the compressive value. Brittleness is also a characteristic that must be considered along with low tensile strength when selecting an optimum design of tool-holder and tool geometry. However, by proper design of the tool-holder, these effects can be minimized, while full advantage is taken of the good compressive characteristics and elevated-temperature hardness.

Thermal conductivity of high-density alumina is relatively low compared to that of metals, but is adequately high for a tool material. Therefore, heat can be dissipated through the tool to reduce stresses due to temperature gradients. This aids in reducing thermal shock as a cause of failure.

Coefficient of thermal expansion of sintered-alumina tools is also low compared to that of most metals (of the order of one-half that of ordinary carbon steel). The low coefficient is an advantage in minimizing thermal shock failures, but is a definite disadvantage to brazing or cementing to steel shanks where the large differential sets up troublesome stresses in the fastening medium. However, the use of clamp type holders overcomes the latter problem and are satisfactory for most applications.

Sintered-alumina bodies produced for ceramic tools have a considerable advantage over many other ceramic bodies in that they are a single-phase body possessing a very high degree of homogeneity. Thus, while the thermal shock resistance is not outstanding, it is known and substantially free of fatigue effects, which allows for satisfactory compensation in the design of tool-holders and operating machines. Table 1 gives

the general physical properties possessed by the more advanced tools now on the market.

Grades of Ceramic Tools

Grades of ceramic tools are not identified as such. The development is too new to have set and correlated grade designations for each manufacturer or producer. Each is striving to produce an optimum all-purpose grade which may or may not be possible and practical. The important thing to recognize is, however, that different grades of ceramic tools do exist even though they are not currently identified.

Independent tests have shown a great deal of difference performance-wise between various makes of American and foreign tools. Most of the leading manufacturers have already changed their grades several times in an effort to get improved cutting action on a particular work material. It is understood that the majority of these manufacturers are continuing their efforts to develop new grades that will further improve cutting action.

At least one manufacturer is carrying out an extensive program with a government agency aimed toward producing a tool and geometry for the specific purpose of machining alloy steels in the 500 Bhn range at speeds double to triple those now possible. So it appears evident that investigators of ceramic tools for any specific purpose should evaluate tools from a variety of sources until at least such time as a universal grade system has been established.

Initial grades of tools will probably be established as a compromise between hardness and toughness for the particular work to be accom-

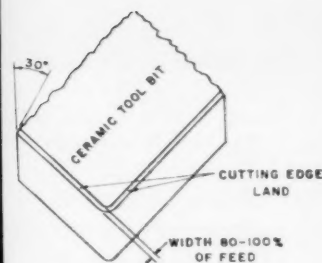


Fig. 3. Studies have shown that an edge land of any size and angle will materially increase resistance to flaking. Superior results have been obtained with a 30-degree land ground to a width approximately equal to 80 per cent of feed.

Table 1. Typical Physical Properties of Ceramic Tools

Density	3.98 (plus) gm/cc	Coefficient of friction on steel	0.17
Modulus of elasticity	60,000,000 psi	Resistance to acid and alkalis (room temperature)	Not attacked
Transverse rupture strength	65,000 psi	High-temperature hardness	Excellent to 2000° F.; decreases slowly above
Compressive strength	400,000 to 500,000 psi	Thermal conductivity	35 Btu-inch/hour/square foot/°F. at 2000° F.
Coefficient of linear expansion $9.0 \times 10^{-6}/^{\circ}\text{C.}$	25 to 1200° C.		
Melting point	3600° F.		
Resistance to oxidation	Cannot be oxidized		

plished. For example, tool bits may be made with improved shock resistance at the expense of wear resistance. Thus, the range of application of ceramic tools will undoubtedly be widened, depending on the properties designed into them.

Operating Conditions

Probably the most important factors today in the use of ceramic tools are the conditions under which they will be applied, which involve, among others:

1. Tool geometry;
2. Methods of holding and supporting the tools;
3. Machine requirements;
4. Condition of work-piece and type of cut;
5. Speeds, feeds, and depth of cut.

Tool Geometry—The physical properties of ceramic tools versus the cutting forces applied during use necessitate the employment of geometries that will minimize fracture failures.

Generally, aluminum-oxide ceramic-tool material has a compression strength of 400,000 to 500,000 psi, a traverse rupture strength of 50,000 to 90,000 psi, and a tensile strength somewhat less than the latter. It thus becomes obvious that tool geometry should favor the use of the compressive properties of ceramics.

Use of positive and negative rake angles has been widely studied and debated. Experiments in nearly all cases have indicated the necessity of a negative rake at the cutting edge for a distance equivalent to the feed per revolution in order to realize a substantial tool life. The top of the tool may be raked positively or negatively from this point, depending on the work-piece material or the chip control desired. The object of the negative rake is to avoid, or minimize, tensile stress

at the cutting edge. In general, cutting angles within the following limits have been used successfully on a variety of work materials (Fig. 2):

1. Side cutting-edge angles, up to 60 degrees;
2. End cutting-edge angles, 5 to 20 degrees;
3. Back- and side-rake angles, 0 to 10 degrees negative;
4. Relief angles, 2 to 10 degrees;
5. Nose radius, up to 1/8 inch.

Use of throw-away type square inserts in mechanical tool-holders resulting in a 5- or 7-degree negative back and side rake, and the same relief angles, has given satisfactory performance. Negative rakes provide maximum support for the cutting edge by their action in shifting resultant cutting forces back into the body of the tool. In certain instances, severe negative rakes have been employed to give the necessary added support to compensate for the low tensile strength inherent in ceramic bodies.

One tool-life study revealed that side-rake angles up to minus 15 degrees showed advantage, as did back-rake angles to a similar figure. Increased lead angle also showed an increased tool life by reducing the unit pressure on the cutting edge—but to a lesser degree than the changes in rake angle. The end-relief angle could be varied between 3 and 10 degrees without significant change in tool life, whereas the side-relief angle appeared to be optimum between 12 and 15 degrees. Nose radius appeared to be important, and showed substantial increase in life up to 1/16 inch, with no further gain beyond this point.

Extensive work has been carried out at Ohio State University in studying high negative rakes placed directly at the cutting edge in the form of chamfers or narrow lands. The objective was to reduce edge chipping, or flaking, and thereby

increase tool life. Tests showed that the presence of an edge land of any size and any angle will produce much improvement in resistance to flaking. Results further showed that the use of an edge land approximately 30 degrees from the vertical, and ground to a width of approximately 80 per cent of the feed, works well in increasing tool life and resistance to chipping, Fig. 3.

There is preliminary evidence to suggest that some shape of edge land other than flat may be optimum. Convex lands are currently under scrutiny, as they can easily be applied by tumbling with an abrasive medium.

Examination of a cross section through the cut-

has proved successful for certain light machining operations. It is doubtful, however, that adequate support can be attained for other than finishing cuts. An appreciable thickness of tool bit is required to insulate the cement from the high temperatures generated at the cutting edge in order to preserve the fastening properties of the cement.

Clamp type tool-holders were first developed for cemented-carbide tips to avoid stresses introduced during brazing, and thermal stresses arising from the different expansion coefficients of the carbide tip and the steel shank. As ceramic tools are even more sensitive to these stresses, it is a natural step to take advantage of the tool-

Table 2. Basic Range of Cutting Speeds Using Ceramic Tools

Material	Range of Cutting Speed, sfpm
Mild steels	500 to 2000
Hard tool steels	150 to 500
High-strength alloy steels, 200,000 psi up	250 to 750
Cast irons	150 to 1500
Chilled cast iron	66 to 150
Brasses	1000 to 2500
Aluminum alloys	1000 to 7200
Nonmetallics	200 to 2000

ting edge of one experimental tool that gave an extraordinarily long tool life appears to show a wear pattern that simulates a convex land, Fig. 4. A crater caused by the chip rubbing along the top surface of the tool is indicated at C. (It has been said that ceramics do not crater, but this is a matter of degree. It is more accurate to say that ceramics crater relatively slowly.) The cutting edge or cutting-edge land *L*, which was originally flat, has assumed a convex shape during an extended operating period. Flank wear is indicated at *F*. Further studies of flank wear, which is usually the limiting factor in tool performance, are shown in Fig. 5.

Methods of Holding and Supporting—Methods of fixing ceramic tools to steel shanks fall into three categories: brazing, cementing, and mechanical clamping. The usual brazing or soldering procedures do not work with ceramic tools because of poor wettability between metals and ceramics under ordinary conditions.

Cementing of the tool directly to the steel shank with an adhesive such as an epoxy resin

holder development work already underway and then adapt currently available clamp holders.

A typical throw-away insert type of tool-holder is shown in Fig. 6. It has a carbide support anvil and a carbide clamp block in the form of a chip-breaker with ground surfaces. This is to provide maximum area contact with the ceramic insert in order to prevent flexing and localized clamping or cutting pressure. Rigidity is necessary whenever ceramic tools are used and dictates the desirability of employing as large a tool-holder and shank as possible.

The mechanically clamped holder offers the greatest support to the tool, since negative rake angles can be readily obtained and the mechanical chip-breaker can be arranged to distribute the clamping forces equally. It is important that the chip-breaker be adjusted to curl the chip above the holder for proper breaking.

Carbide shims are a must for the proper support of the tips, and some experiments have indicated a direct relationship between thickness of the ceramic tool and its contact area with the

shim. Some users consider this sufficiently critical so that they lap the ceramic tip to the shim for complete contact. Others have found that a thin sheet of soft aluminum foil (0.001 inch thick) between the bit and anvil serves to iron out irregularities and reduce fracture failure. Thicker foils are less effective and above 0.005-inch thickness can actually be a detriment.

Machine Requirements—Machines suitable for using ceramic tools are as important as the tool-holders. Modern machine tools on the market today have the power and range of speeds needed to use ceramic tools effectively. Rigid conditions are required for the best application of these tools. Elimination of all sources of vibration is desirable in all machines in which ceramic tools are run. This includes maintaining tight clutches, finely adjusted bearings, well-balanced

chucks or driving dogs, tailstock and slide-ways in good condition, etc. Isolation from adjacent machines causing vibration is also desirable.

Wherever possible, it is suggested that the potential user of ceramic tools choose a machine tool with the following considerations in mind: (1) a reserve of power is available to handle higher speeds and higher horsepower requirements; (2) condition of the machine is such as to have minimum vibration; (3) machine has adequate operator protection for high-velocity chip making.

Effects of Machining Variables—A knowledge of the effects of machining variables is essential to the successful application of ceramic tooling.

As a general rule, ceramics will perform successfully at two to three times the surface speeds used with carbide tools on heat-treated or high-strength steels having strengths up to 250,000 psi. On low-tensile steels much higher ratios are achieved under certain circumstances.

As a guide on ordinary carbon steels, work speeds below 300 sfpm tend to be uneconomical, and those above 2000 sfpm present problems in chip handling and short tool life. At speeds above 600 sfpm the tool cutting edge becomes red hot and the area thus affected increases as the speed rises. One theory holds that this is a desirable situation, as longer lives have been measured for the hotter tools as opposed to a tool operating under the same parameters except for a lower edge temperature.

Changes in feed rate within the maximum capacity of edge strength of a ceramic tool have little effect on the life of the tool as long as the original cutting-edge geometry is maintained. However, frontal wear of the cutting edges increases rapidly above a certain optimum feed rate for each given work speed and causes a geometry change that can result in early failure by massive fracture from overloading. In general, for annealed stock, feed rates up to 0.020 ipr will be found satisfactory for speeds up to 800 sfpm, while feed rates up to 0.012 ipr work well at speeds between 1000 and 2000 sfpm.

Similarly, variations in depth of cut have little influence on the wear of the tool. It does not follow, however, that tools can take unlimited depths of cut. A point is reached where total loading exceeds the allowable limit of current supporting systems for holding ceramic tools.

The effect of shock as a result of interrupted cuts or cyclic stressing has received too little study to arrive at definite conclusions regarding the behavior of ceramic tools when used in these types of operations. However, it certainly is not correct to conclude in a general statement that ceramic tools cannot be expected to perform under variable-stress conditions. Certain grades

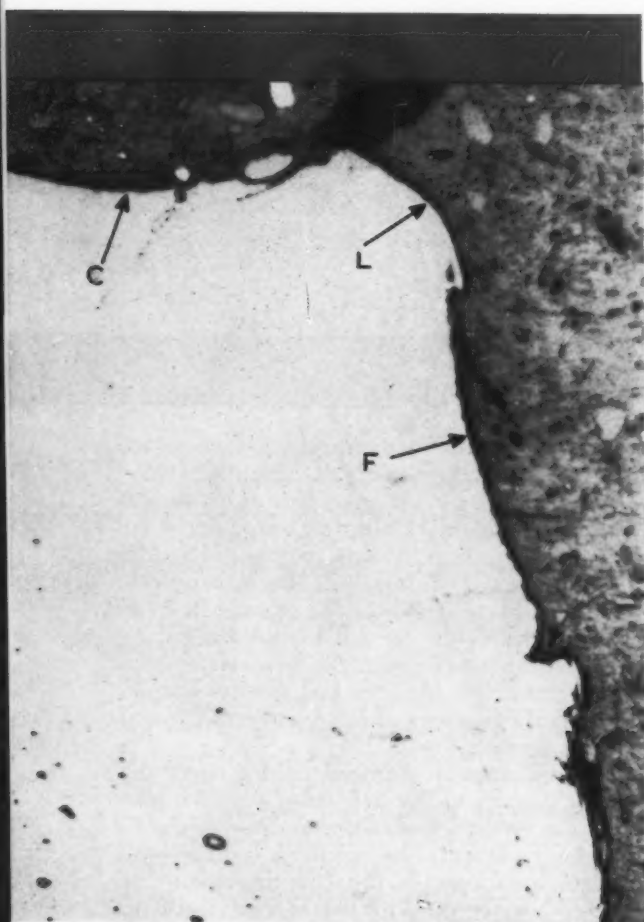


Fig. 4. Cross section through cutting-edge land (200 \times magnification) after tool had been used to remove 5000 square inches of stock. The land (L) was originally ground flat, but appears to have assumed a convex shape.

of ceramic tools have performed extremely well under specific sets of conditions, but tool material, support, and geometry become much more critical in this type of work.

Wear lands (flank wear) develop at a somewhat slower rate than with carbide tools. Also, it does not appear desirable to use ceramic tools to the same degree of flank wear common with carbide tools. For example, a flank wear of 0.030 inch is common for carbide tools, but is likely to result in excessive pressure and massive fracture of ceramic tools. A limit of 0.015-inch flank wear for ceramic tools is a much better point at which to index to a new cutting edge.

Although the effect of chip-breaker adjustments has already been pointed out, it is worthwhile to re-emphasize that failure to properly adjust the chip-breaker may cause the chip or machined ma-

terial to contact the face or the edge of the tool, and this may produce cracking, erosion, edge chipping, and premature tool failure. An adjustable chip-breaker is therefore considered mandatory on jobs where work conditions and materials vary. It is most important that it be adjusted to curl the chip above the top clamping surfaces of the holder for proper chip breaking.

Operational Test Data—Modern ceramic tools are sufficiently new so that long-term test data with respect to speeds, feeds, and depths of cut are not yet available. However, sufficient test data have been compiled to present a preliminary table, covering certain materials, that can be used as a guide for setting up an evaluation program (see Table 2).

Experience indicates that the most satisfactory speeds to use on the machining of steel with ce-

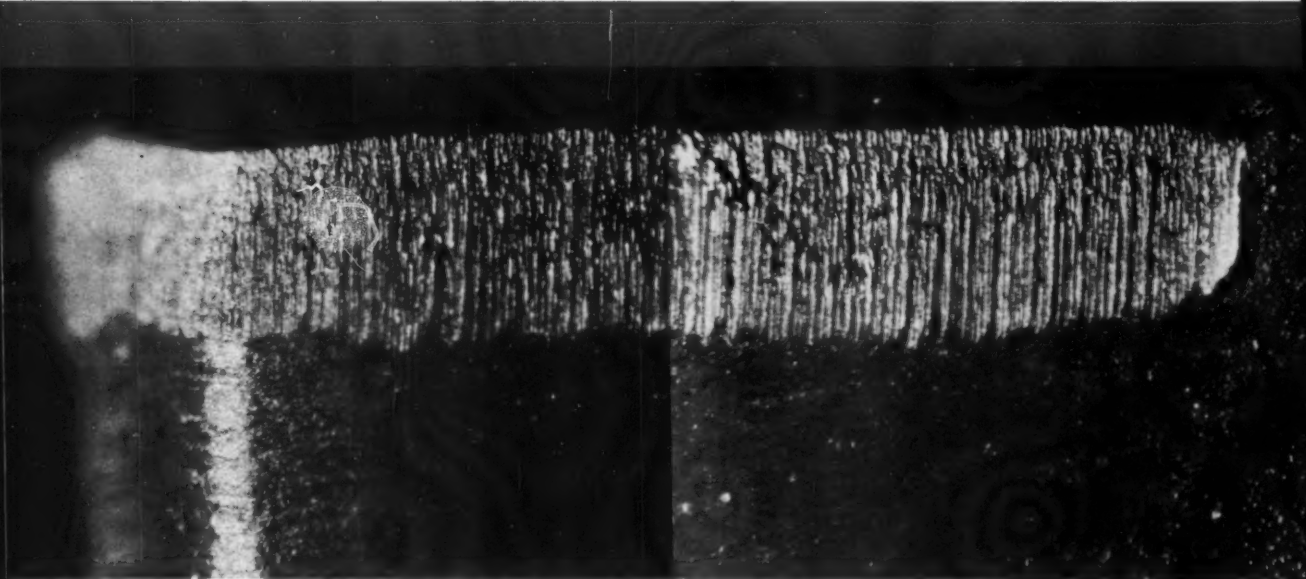
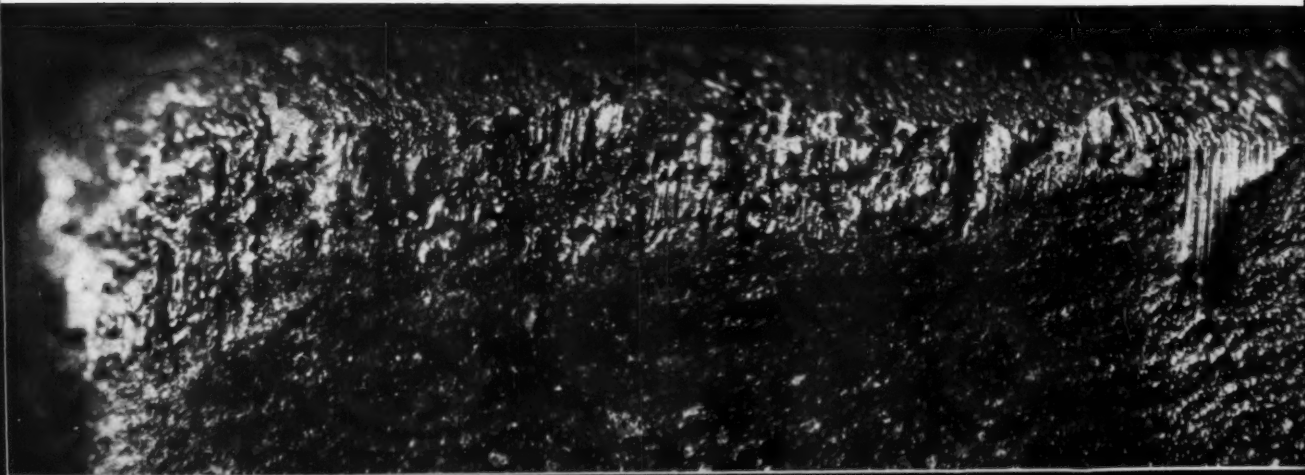


Fig. 5. Further examples of flank wear on ceramic tools (45 \times magnification). Cutting-edge flank (top view) shows even wear, indicative of good performance. On the other hand, another flank (below) shows uneven wear, indicative of poor performance.



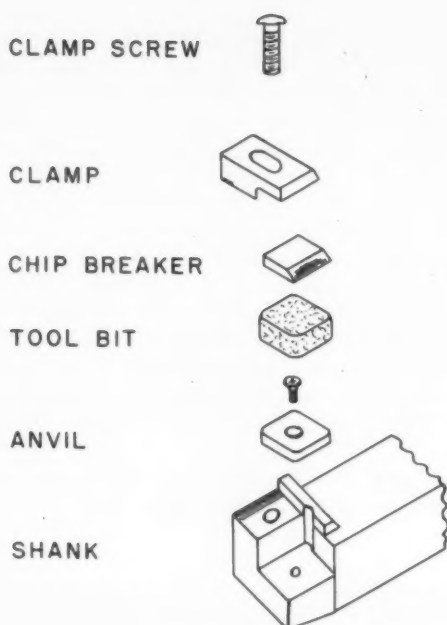


Fig. 6. Elements of a typical throw-away insert holder for ceramic tools. Carbide support anvil and carbide clamp block—in the form of a chip-breaker—have ground surfaces for maximum contact area. This prevents flexing and localized pressures.

with substantial depths of cut generate hot chips, forming high-velocity projectiles that can seriously affect operators and equipment performance.

Safety shields over the chuck and on the tool-post carriage have proved efficient in controlling the chip barrage. If machines are closely grouped, it is necessary to provide complete enclosure of the work-piece to prevent saturation of the shop with hot chips.

Practical Applications of Ceramic Tools

Practical use of ceramic tools depends to a great extent on the proper tool selection and application and has been limited mainly to single-point turning operations. Machining with these tools has revealed their suitability for working materials, such as cast iron, bronze, plastics, graphite, copper alloys, and green ceramics, that involve low cutting stresses but which may have a definite abrasive character.

With respect to steels, the practical use of ceramic tools has progressed somewhat slower to allow necessary improvements in tool compositions. Satisfactory performance has now been achieved but is restricted to certain categories of steels and cast irons.

Some of the successful categories are:

1. Carbon and low-alloy steels up to 35 Rockwell C. These steels are machined with ceramics at speeds above the conventional tool-speed range, resulting in increased productivity. Certain applications have shown better tool life within the conventional tool-speed range.
2. Hard tool steels up to 65 Rockwell C. These steels can be machined with economical tool life, whereas conventional tools have difficulty with hardnesses in excess of 35 Rockwell C. An excellent surface finish is produced on these hard materials, one which is sometimes competitive with ground surfaces. Size can be held within normal turning tolerances for much softer materials.
3. High-strength alloy steel (such as 4340 heat-treated to above 200,000-psi tensile strength). This type of steel is machined with selected ceramics at above the conventional tool-speed range with increased productivity.
4. Cast iron and cast semisteel. Both of these materials are cut at conventional tool speeds with superior tool life, and exhibit satisfactory tool life in higher speed ranges. Scalping, roughing, and finishing cuts can be accomplished

amics range from 400 to 1500 sfpm, with feeds of 0.004 to 0.032 ipr and depths of cut from 0.010 to 0.625 inch.

Much has been said about ceramic tools being useful only for finishing cuts, but this is contrary to recent findings where substantial use is being made on stock-removal jobs. Practical indication of this was an investigation of the use of ceramic tools for machining high-strength steels at a large United States Army arsenal. The material was 4340 (200,000-psi tensile strength) steel, 11 inches in diameter and 22 feet long. It was turned on a 50-hp LeBlond lathe using a roller-bearing steadyrest. A 3/4-inch square, 1/4-inch thick VR-97 ceramic insert was clamped in a standard tool-holder providing a negative 5-degree back rake and a negative 5-degree side rake. Nose radius was 1/16 inch, and a cutting-edge land was ground at a 30-degree angle by 0.010 inch wide.

The cut consisted of roughing through scale and was done at a speed ranging from 380 to 420 sfpm at a feed rate of 0.017 to 0.025 ipr. Depth of cut averaged 0.375 inch, but went as high as 0.625 inch.

Stock removal increased from an average of 28 cubic inches per minute with carbide tools to an average of 66 cubic inches per minute with ceramic tools. Total machining time was reduced from eleven hours to six hours with no sacrifice in tool life. This is now a full-time production application.

Safety—At the higher operating speeds possible with ceramic tools, safety measures and operator protection are a must. Speeds above 1000 sfpm

Table 3. Ceramic-Tool Compatibility Chart

Excellent	Nickel
	Cobalt
	Gray cast irons
	Steels and inoculated cast irons
	Lead
	Silver
	Copper
	Aluminum
	Beryllium
	Titanium
Poor	

equally well at high production rates with economical tool life when machining carbon, low-alloy, and high-strength alloy steels with proper selection of tools, holding fixtures, tool geometry, and lathe rigidity.

On the other side of the picture, certain metals having a tough tenacious characteristic along with a measure of ductility cannot be considered successfully machined with ceramic tools at the present time. These materials include some stainless steels, high-temperature alloys, and titanium. They are currently cut with conventional tools of high positive rake having high edge strength. Neither of these is a virtue of the current ceramic-tooling system.

It is interesting to note that while stainless steel is not satisfactorily machined in the annealed condition by ceramic tools, it has been successfully handled by ceramic tools with normal procedures when heat-treated to a tensile strength of 160,000 psi or above.

Present Status of Ceramic-Tool Development

The status of ceramic-tool development has been widely discussed and sometimes overstated. Nevertheless, ceramic tools have now reached a stage of development that allows successful lathe turning of many materials. Milling, drilling, reaming, and similar operations are under investigation. However, while initial results have been encouraging, more time is required to establish performance status.

Cutting tests have shown that with proper equipment, machining techniques, and tool geometries, the full potential of these tools as a stock removal or a finishing medium can be realized for carbon steels, high-strength alloy steels, high-hardness steels, and cast irons. Heat-resisting properties of ceramic tools enable them to be used at cutting speeds unattainable by other tool materials and with consequent high stock-removal rates. Tool life stands out at the higher cutting speeds with a correspondingly superior work finished produced. While these advantages appear impressive, the field of chip production is just being broken into. Much work remains to be done in evaluating ceramic tool life for other work-piece materials and establishing new useful machinability parameters or criteria.

The manner of failure in ceramic tools, which is different from other tools, also needs considerable study. Limitations of current ceramic tools are mainly their tensile strength, shock resistance, and inconsistency of performance. All of these have recently been improved considerably.

Looking to the Future

It is too soon to determine accurately the future placement of ceramics in the metal-cutting industry. Nevertheless, practically all investigators are optimistic. Test results support this optimism and indicate a wide potential for reduction of machining times with consequent increase in output for a wide range of work materials.

It is equally apparent that material, tool, and methods engineers will have to do extensive development work before ceramics achieve the status comparable to that now existing with carbides. Makers of ceramics and designers of machine tools will have to cooperate in their respective fields.

It is widely speculated that ceramic tools, when marketed on a large scale, will be less expensive than cemented carbides. In practice, however, the current difference in price between these two materials favors the carbides by the order of 2 to 1. Although the raw material required for sintered ceramic tools is generally more available and cheaper than for tungsten carbide, a very high-purity, high-quality alumina powder is required. The difference in price between tungsten carbide and this alumina powder is smaller than generally supposed. Material cost, however, is but a small fraction of the total tool cost.

Abstract of chapter entitled "Ceramics for Cutting Purposes," in *Modern Materials, Volume II*, published by Academic Press Inc., New York City.

Numerical Control Opens New Horizons in Inspection

Measuring machines operating under tape control check hundreds of dimensions on complicated parts at unheard-of speed. Deviation of a work-piece from required sizes can be automatically recorded on punched cards or tape as a permanent record for quality control. A new concept is the use of inspection output data for design purposes

Practice

HAROLD W. BREDIN, Associate Editor

TODAY, numerically controlled machine tools are making intricate and precise parts faster than ever before thought possible. To keep pace with the increased output, manufacturers are now faced with the necessity of inspecting these highly complex parts in a comparably much shorter time. This is becoming more and more difficult with conventional inspection methods, since the checking of such parts is often more time-consuming than the machining. Logically enough, however, numerical control—in the form of inspecting machines—is now being called upon to alleviate the problem it has created.

High-Speed Inspection by Tape

Recently developed universal measuring machines equipped with numerical control provide a rapid and automatic means of checking the most complicated of components. They have extremely accurate self-contained measuring systems and can, from inspection procedure data on punched tape, automatically place a gage point at any position in space within the physical operating limits of the machine, as determined by the maximum extension of the various slides. Their use can save the cost of expensive inspection fixtures. In addition to tape input, some machines have the ability to provide tape output in the form of read-out of inspection results, recording the measured deviations of a part from the design dimensions. Special-purpose tape-controlled measuring machines, made for inspecting a particular part, are also coming into use.

A universal type numerically controlled measuring machine of an advanced eight-axis design is seen in the heading illustration. Developed by Pratt & Whitney Co., Inc., West Hartford, Conn., this equipment is similar in construction to jig borers made by the company, but with the necessarily accurate measuring system more highly refined and several additional axes of motion provided. The principle of using a jig borer as a measuring machine is not new. Work-pieces machined on less accurate equipment are often checked out on jig borers. Even parts machined on a jig borer are sometimes checked out on the same jig borer by running through the operations a second time with a gage point put in the place of the cutter. The gage deviations indicate mistakes by the operator; how the cutter reacted during machining; what inaccuracies were introduced due to bending moment caused by high contact pressures between the cutter and work-piece; and what distortion was present in the part due to poor clamping, especially in the case of thin-wall parts. (Since contact pressures are greatly lessened during inspection, a minimum

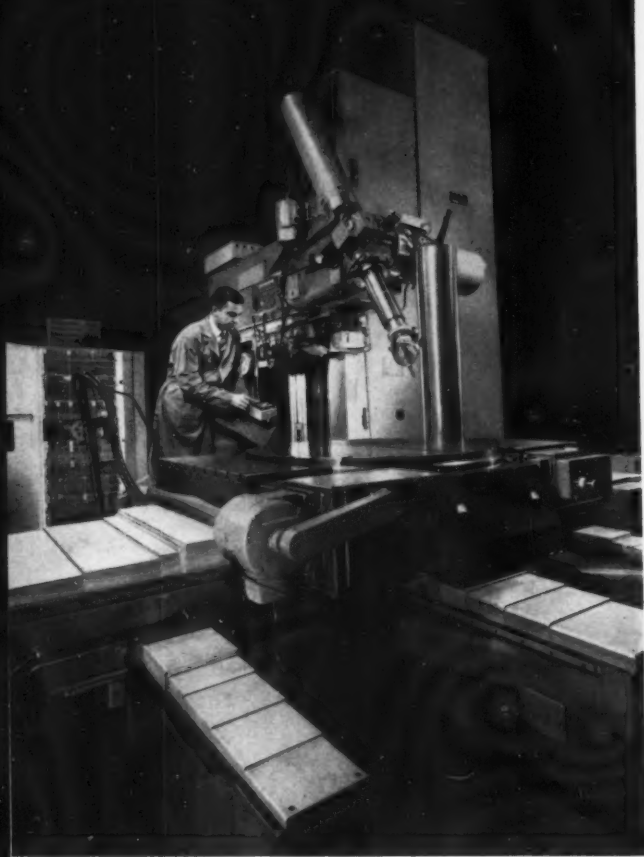
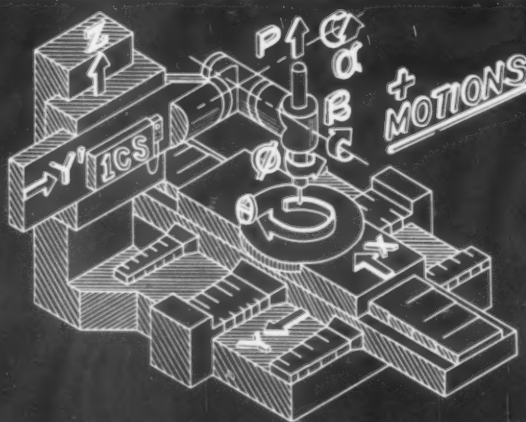


Fig. 1. (Below) Here, an operator is setting the motorized quill of the eight-axis inspection machine seen in the heading illustration by means of a push button and an optical scale. This is only necessary when holes at an angle to the main axes of the part are checked.

Fig. 2. (Right) The various axes of adjustment and motion of the eight-axis machine. Motion on axes X, Y, Z, Y', and θ are under tape control. Swivel movements α and β , quill adjustment P, and tramping motion ϕ are controlled by push button.

amount of clamping is necessary.) The same type of inaccuracies, with the exception of operator failings, can be produced in parts made on tape-controlled equipment.

On the eight-axis measuring machine, the three major slides, the ram, and the built-in rotary table are numerically controlled. A rotatable quill and an associated swivel arrangement are motorized but manually set (Fig. 1) to an optical scale by push-button operation. The various motions of the eight-axis machine are shown in Fig. 2. The purpose of the swivel mechanism and quill is to inspect the location, alignment, and concentricity (by tramping) of holes and curved surfaces having an axis at an angle (or compound angle) to the main axes of the work-piece. This often permits complete inspection from a single setup. Most parts can be entirely inspected with only the use of the five tape-controlled movements. The high order of accuracy built into this equipment is such that the composite position of all five slides cannot be measured to the same degree of exactness using conventional inspection techniques. Electronic "Nixie" tube read-out of com-



mand or gage-point position is provided for the five numerically controlled axes. A small Trans-O-Limit gaging head, which provides electronic-meter read-out of part deviation, is employed. Work-pieces up to 100 inches in diameter can be accommodated.

Digital Read-out of Inspection Results

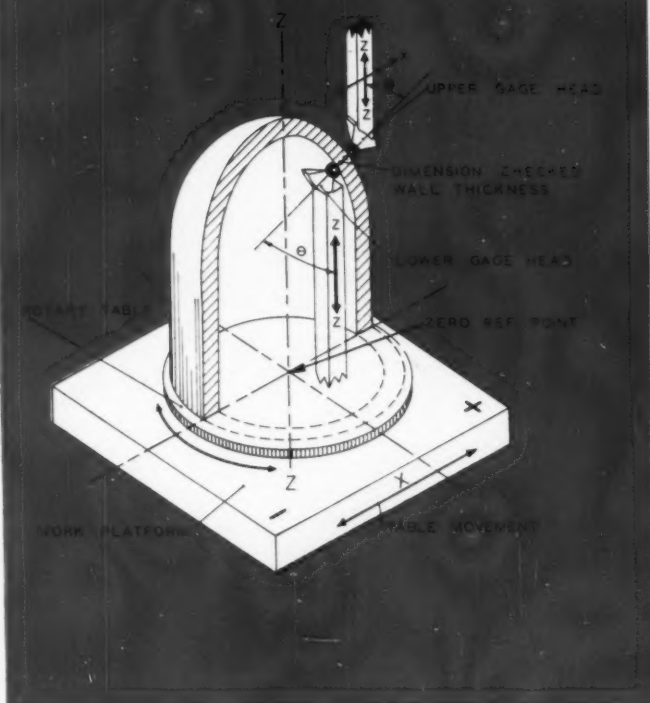
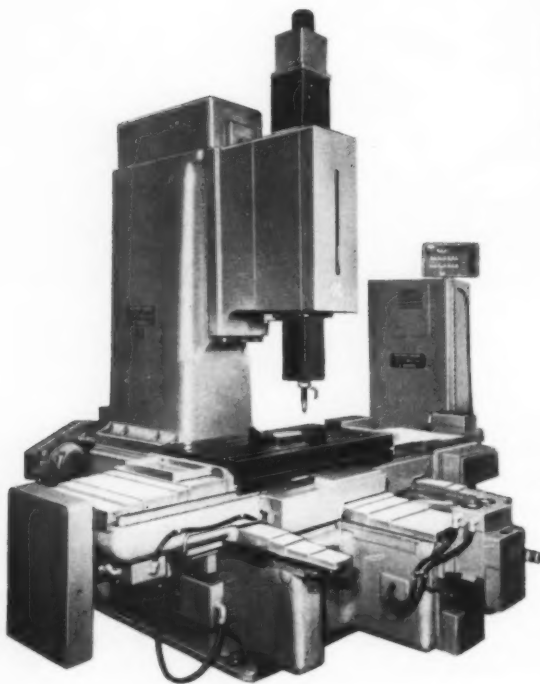
The two-axis universal numerically controlled measuring machine shown in Fig. 3 is also based in construction on a jig borer. A square quill re-



places the usual cylindrical quill to provide greater accuracy. Developed by Pratt & Whitney, this machine is capable of automatically checking close-tolerance dimensions of templates and part profiles to within 0.00005 inch. Visual, chart, and digital read-out of deviations from nominal dimensions are possible.

By means of two gaging heads, the inside and outside surfaces and thickness of hollow cylinders, cones, and other more complex parts having surfaces of revolution can be checked at hundreds of reference points under tape control in a Pratt & Whitney six-coordinate inspection machine. The basic arrangement of this machine is shown in Fig. 4. Each head is capable of moving in X, Z, and θ coordinates (horizontal, vertical, and rotary movement), one head inside and the other outside the part. Read-out is digital and can be stored, recorded, or mathematically processed.

Although not a true numerically controlled measuring machine, the multiple-gage "Unicomm" contour-measuring equipment seen in Fig. 5 does provide a punched-tape record of inspection results. This special equipment is designed to gage both the inside and outside surface of parts having either cylindrical or complex surfaces of revolution, such as nose cones. Thickness is also measured. Gage points are placed on supporting arms normal to the outside and inside surfaces at positions where accurate dimensions must be held. The part is rotated continuously or automatically



indexed according to a preset inspection procedure. Swinging the outside gage arm to the right brings it into contact with a master contour template of the required shape of the outside surface. Simultaneously, a master contour template of the inside surface on the same column is swung into position to master the gages checking the inner surface of the part.

Inspection Data Used for Design Purposes

Punched-tape read-out of inspection data has led to the evolution of a new engineering concept, the use of measuring machines as a design

Fig. 3. (Left) Two-axis numerically controlled measuring machine for automatically checking flat templates and part profiles. Gage-point positioning on X and Y axes is directed by punched tape or telephone dial.

Fig. 4. (Above) Basic concept of six-coordinate inspection machine with two gaging heads. Each has tape-controlled positioning in X, Z, and θ axes. Inside and outside surfaces and thickness of cylinders, cones, and other complex parts having surfaces of revolution can be gaged simultaneously.

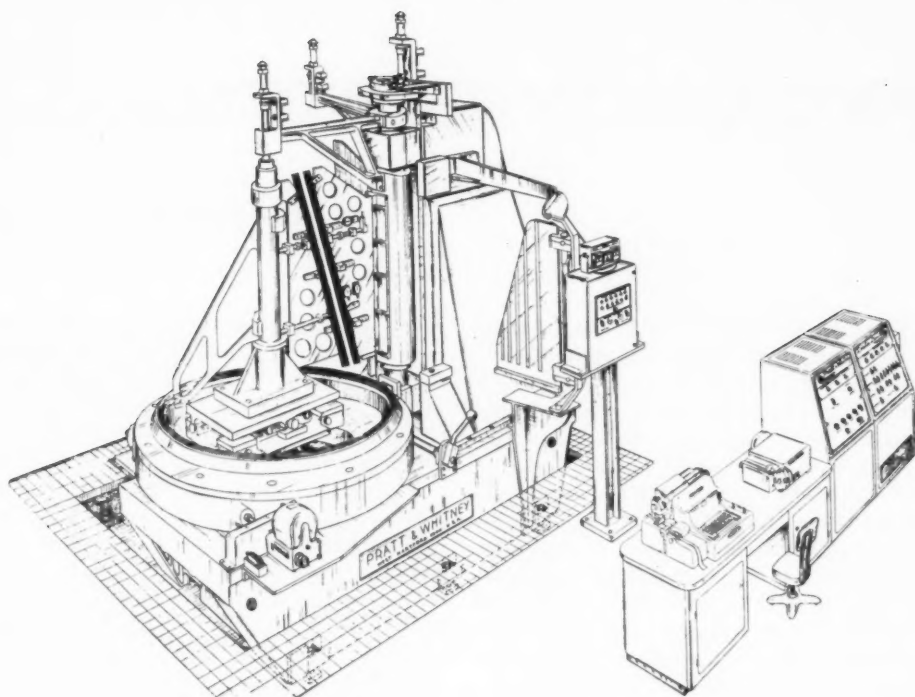


Fig. 5. Tape output of inspection data is provided by this machine for measuring parts such as cylinders or nose cones. Multiple gages on the two gaging arms are manually set and checked by two contour masters—one seen at right and the other shown attached to the post carrying the outer gaging arm. (Gage points have been masked to avoid disclosure of a work-piece contour.)

tool in the development of new products. Some interesting applications of inspection read-out data for design purposes are possible.

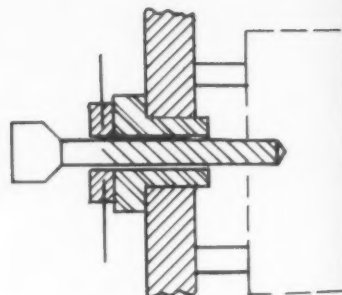
Recently a special automatic gaging device with digital, punched-card read-out was developed for checking channel-shaped fuel elements for a nuclear reactor. Nine readings were required to be taken on the cross section of the element at 45 different positions along the length—a total of 405 different dimensions, recorded on punched cards. This data is then used as a permanent record for size comparison in order to improve the design of fuel elements.

A unique case not involving the use of these inspection machines may, however, also foretell of a whole new relationship between design and production functions developing out of comprehensive use of numerical control. Error-compensating cams for azimuth indicator rotary tables (whose ultimate use is concerned with the aiming of guided missiles) are made on a numerically controlled Keller machine that is programmed directly from digital design data. The cams are machined without even preparing a drawing, since

the design data is computed from inspection results obtained in measuring the errors existing at each degree setting of the rotary table on which the cam is to be employed. These cams are used to provide electrical compensation for the physical errors that are in each table. In this way, an azimuth indicator table is improved from one that is accurate within ± 7 seconds of arc to one that is accurate within $1 \frac{3}{4}$ seconds of arc. The whole operation is automatic from the time the inspection results are received by the data-processing section and requires less than a half day. This is in spite of the fact that a cam is custom-made for each table.

The principle of making a nonoptical, mechanical table from one that is essentially standard in construction into one of the most accurate tables available through cam compensation for measured errors can be applied to many other uses. It is an excellent example of how inspection data can be used for design purposes. The error-compensating cams are cut to a shape which represents the actual errors in the rotary tables magnified to a large ratio.

PROXIMITY SYSTEM



IN THE OPERATION of mechanized equipment, especially transfer machines, the immediate detection of broken tools safeguards production, minimizes scrap losses, and prevents damage to tooling at subsequent stations. For example, failure to detect a broken drill at one station will automatically set the stage for breaking a tap or reamer at the next station.

There are a number of pneumatic, mechanical, and electrical systems for detecting broken tools. In the pneumatic systems, it is the tool that is usually inspected. However, if a continuous supply of compressed air is not readily available, the system is costly. In some of the mechanical systems, the tool is inspected, while in others, the hole is inspected by a probe. In the latter, the user works from the assumption that if the hole work is correct, the tool is automatically in a satisfactory condition. In all cases, modification of the machine's slide is necessary.

Electrically, there are three popular methods for detecting broken tools: timing the working cycle, load control, and proximity. The first method, that of timing the working cycle, starts with the assumption that the slide should reach a predetermined position after a given period of time. If the tool arrives at position before the normal timing period has elapsed, tool failure is indicated. This system is limited, obviously, to applications where the tool-slide is fed hydraulically so that the infeed cycle is automatically shorter when there is no work load. The second method, called load control, works on the assumption that motor amperage will change whenever the tool begins to cut. But if other variables in the electrical system bring about a similar or greater change of motor amperage, this system cannot be used. Therefore, it has limited applications.

The third is by proximity sensing. This is an electronic system comprising sensing elements and electrical control units for the detection of broken drills, taps, reamers, and tools of a similar nature. The tool is inspected as it passes through a toroidal sensing element mounted directly on

the work station. When a tool breaks, the relay on the master control becomes energized. Contacts on this relay are used in circuits to stop the machine, sound an alarm, or both. Such a system is the Model MEK 5910 Detect-A-Tool, built by Machinery Electrification, Inc., Northboro, Mass.

The broken-tool detector is composed of four parts: the sensing element, the oscillator circuit element, the master control unit, and a limit switch.

The proximity sensing elements are toroidal coils through which the tool operates. They are supplied encased in a steel housing which protects them from oil, water, and abrasives. Their operation is not affected by metal particles, chips, or the movement of large masses of metal in their immediate vicinity. When mounted on drill

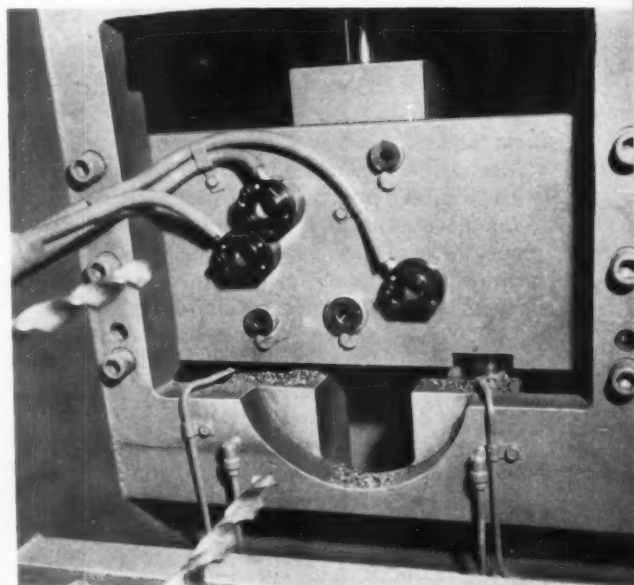


Fig. 1. This transfer machine station has three proximity heads, all of which are located in the same plane because drills are the same length.

... detects broken tools on automatics

A new electrical system supplements automatic mechanical probe methods of sensing when drills and taps have broken off in the work-piece. This attachment has advantages in being independent of drive-motor current, chips within the hole, and movement of large masses of metal.

bushings, their natural position, they are practically immune to wear and damage.

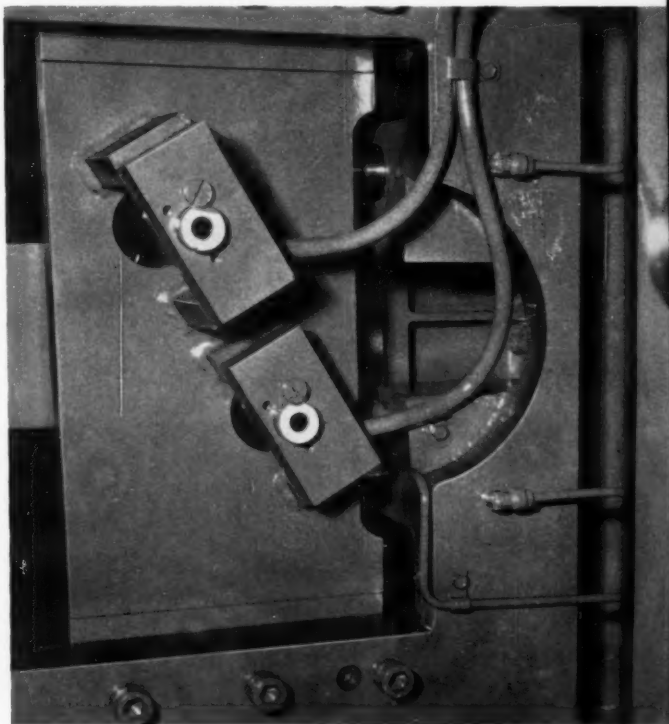
The cable from the sensing head is neoprene-covered and usually is run in steel conduit strapped to the bushing plate. The cable from the sensing head is connected to appropriate terminals on the oscillator unit. No special wiring is required, and cables can be run in the same conduits as power wiring. However, the 15-foot length of the cable cannot be changed lest the altered impedance fail to match that of the oscillator to which it is tuned. Each sensing element works in conjunction with a corresponding oscillator circuit element. These are used with a master control which makes a comparison between the actuation of a limit switch and the arrival of the tool within the sensing element. The limit switch provides a "check now" signal. When this signal is received, a corresponding signal—"tool present"—must be received from the sensing head. If the tool is broken or otherwise

absent, the signal is not received at the proper time. This energizes the master control relay.

A single master unit will control as many as thirty oscillator elements. The limit switch indicates when the tool should be checked in the machine's mechanical cycle. The switch contact closes when the point of the tool enters the flux of the sensing coil on the infeed cycle (called the detect position), and remains closed through the balance of that cycle. The switch contact opens whenever the tool point is retracted beyond detect position.

When a group of holes have the same depth and require the same length drills, each tool bushing is retained by an adapter which acts as a mounting for a sensing head, Fig. 1. The drills

Fig. 2. The two holes at this transfer station are of different depths; therefore, one sensing head is blocked further away from the bushing plate than the other.



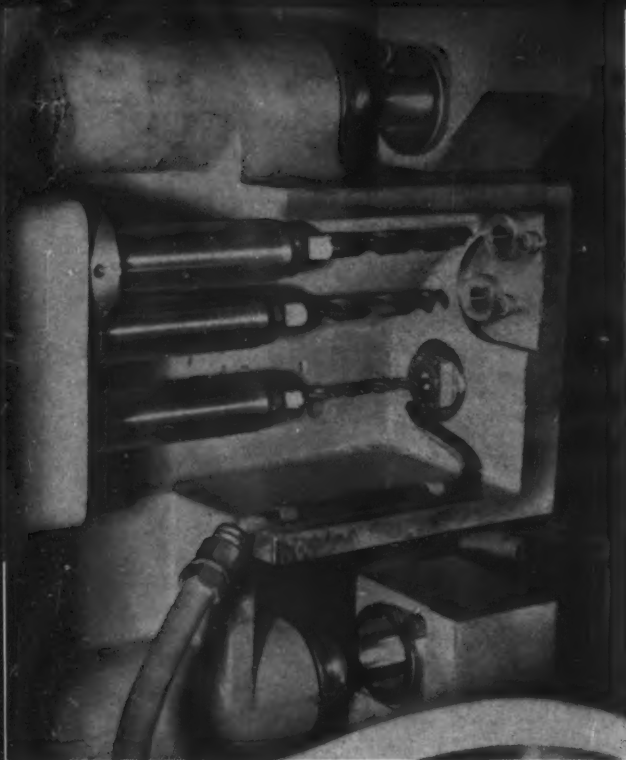


Fig. 3. Only the smaller, more fragile drill is monitored in this installation, which has a reciprocating bushing plate.

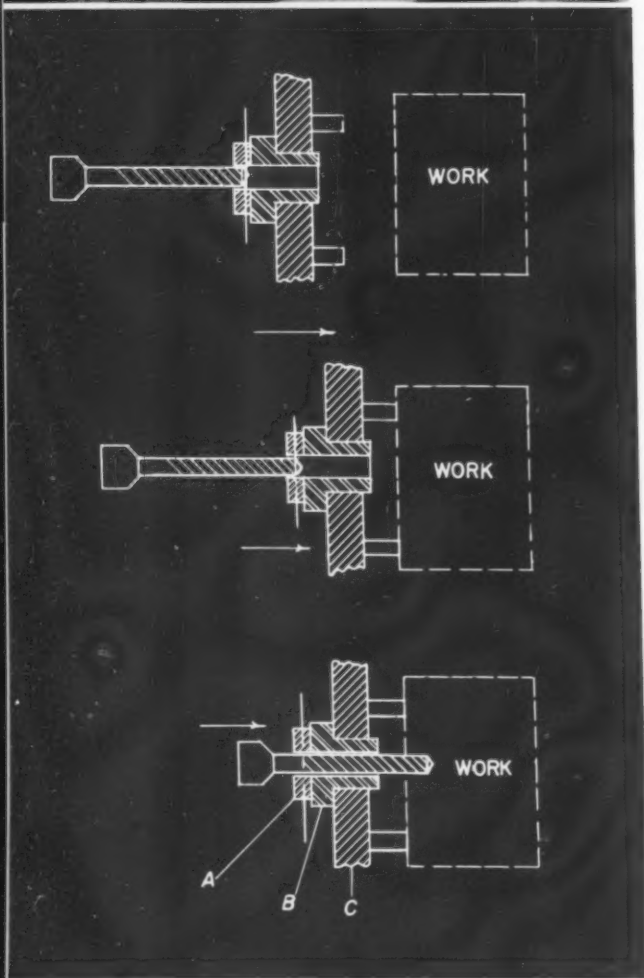
work through the heads. The three sensor cables are wired to one oscillator. If more than three drills must be checked, more oscillators must be added, the oscillator elements being available for handling one, two, or three sensing heads. Thus this transfer drilling station is monitored by three heads, one triple oscillator unit, one master control, and one limit switch.

When the drills are not the same length, it is necessary to mount the sensing heads at different elevations, as in Fig. 2. The sensors are arranged so that the point of each drill is in its correct detect position at the instant when the infeed "check now" limit switch closes. Sometimes this is physically impossible (where the drills are of widely differing length). The solution here is to use two limit switches, and thus two master controls, because two separate comparisons must be made (a master can only make one comparison at a time).

The need for a floating bushing plate to provide clearance for the transfer of work from station to station can sometimes set up a situation, Figs. 3 and 4, in which the limit switch can be eliminated because a time comparison signal is not needed.

Variation in voltage, oscillator tube characteristics, components, and temperature all effect the accuracy of the proximity detector equipment. For simplicity's sake, no electrical adjustments are provided. The variation in detectable tool length (Fig. 4, top), from all factors combined, does not exceed 0.063 inch. If the tool is allowed to extend 0.063 inch beyond the active plane of the sensing head at the moment the limit switch is actuated, components could be changed, temperatures varied over normal limits, and other variations made without false tripping of the warning relay equipment. Actually, in a given installation, it is possible to adjust the limit switch to detect changes in tool length as small as 0.005 inch under constant-line-voltage conditions. Of course, if any parts of the system are replaced, it is necessary to readjust the limit switch. Under some conditions a little fussing with the setup will raise sensitivity to the point where chipping, or even dulling of the drill, will be detected.

Fig. 4. With a movable bushing plate the timing limit switch is not needed because the tool point never backs all the way out of the sensing coil. This sketch shows the relationship of the tool point to the sensor (A), the bushing (B), and the movable bushing plate (C). Drill length is checked at the top position.





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THINKING WITH MANAGEMENT

TIP TO SMALL MANUFACTURERS:

Hire assistants
who will grow
with you

THE MANAGER of a successful and growing small manufacturing firm is almost daily faced with the necessity of delegating duties and responsibilities. He ultimately arrives at a point where he no longer has time to make the detailed day-to-day decisions, much less plan the future course of action, for every function involved in the operation of his business.

Naturally he looks about him and tries to select someone within his organization who can assume the particular task he wishes to delegate. If he cannot find someone within the business, he will look outside and hire someone who can shoulder the responsibility of that particular moment. Here he may fail to consider and evaluate the impact of continuing growth.

It is all well and good to quickly solve today's problem, but the fast solution usually involves the promotion or hiring of a man who is capable of discharging only limited duties and responsibilities involving but a few thousand dollars annually. Many small businesses increase their sales volume by 50 to 100 per cent annually for a period of years, especially if they have a unique service or one-of-a-kind product to offer the buying public. Often the result of such snap judgments is that in a few years a relatively small area of responsibility grows to the extent that it involves decisions affecting not just a few thousand dollars, but many thousands of dollars. More often than not, the man originally selected is not capable of prudently handling this added responsibility. The result is mismanagement. This situation often continues, not only in one or two operations of the business, but in many crucial functions. If management is not cognizant of the impending danger and does not take

decisive action to correct staff weaknesses as they develop, the end result is a poorly managed company.

While the same set of factors operates in a large company, the talents necessary to successfully manage a function involving \$50,000 to \$100,000 are often not significantly different from the qualifications needed to run a \$200,000 to \$300,000 activity. Also, in large companies the rate of growth is usually less steep, and thus more time is normally available for taking corrective action.

One well-documented and major reason many small businesses fail is the fact that they have not been managed well. Even though the owner or president may have been well-grounded in all the latest management techniques, the basic cause of failure was that he did not have time to personally apply obvious rules. Apparently he did not consciously realize what was happening, and thus did not correct the situation. Therefore he was almost sure to run into difficulties.

Some companies have successfully solved the staff-increase problem by never hiring or creating a function manager unless he is a senior and capable man. How is it possible for managers to stay within reasonable financial bounds and still "get by" with this approach? First of all, the firm can afford superior personnel by understanding the problem and being willing either to work harder themselves until they can afford a top-flight executive or, second, by being willing to take a little less out of the business during its early, rapid-growth period.

It is surprising how wide a range of responsibilities can be effectively handled by two or three capable executives who conscientiously supervise the handling of detail work by people of limited ability. Industrial product manufacturers with sales up to \$1,000,000 annually have used the latter approach. This appears to be a volume break point at which one to two capable managers must be added. Exactly how many growth-potential men must be added at a particular time for a given industry and what the general critical volume levels are depend primarily upon the education and experience backgrounds of the active management or the principal active stockholders.

Maintenance Balancing of Jet Rotors Made Faster and Easier



IMBALANCE causes vibration, and vibration means trouble anytime—especially in the ultrafast rotating heart of a jet engine. There, precision balancing is a vital part of the production process and also plays an important role in the final inspection of the finished product in the original manufacturer's plant. But the job is never done. The rotor must be checked and rebalanced on a regular maintenance program that keeps jet engines in tiptop shape always. During production assembly, most jet-engine manufacturers balance individual "stage" components. These components must be balanced again, after assembly, because small individual errors accumulate to result in considerable imbalance in the final rotating mass.

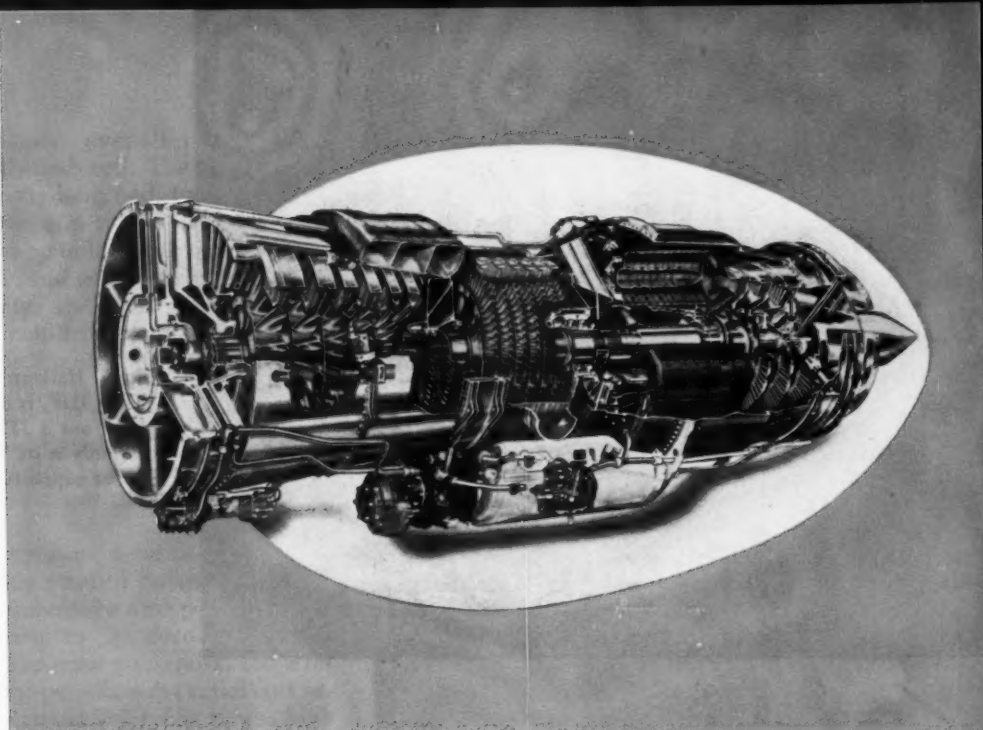
Balancing is no problem to the original manufacturer who uses high-production techniques and modern equipment to meet rigid accuracy requirements while simultaneously keeping costs at a minimum. However, it can pose a problem to the operators of airlines. Jet engines must be completely dismantled for maintenance inspection and overhaul purposes, at periodic intervals, to assure complete operational dependability. The inspection includes balancing of all rotating members, whether or not parts are replaced, since the simple procedure of disassembly and reassembly may create new imbalance effects that must be eliminated.

A newly completed installation in United Air

Lines' turbine overhaul facility at San Francisco's International Airport shows how efficiency and peak accuracy can be obtained in maintenance rotor-balancing operations, while economy is also enhanced.

The carrier's planes use Pratt & Whitney Models JT-3C6, JT-3C7, JT-4A3, and JT-4A9 engines. In setting up their maintenance installations, United Air Lines does not compromise with precision; therefore it uses the latest, most accurate balancing equipment it can find for this vital work. It has followed Pratt & Whitney's recommendations for balancing. Techniques include the use of a Gisholt Type UJP balancer for belt-driving the compressor and turbine assemblies, and the same builder's Type 2SV1 vertical balancing machine, Fig. 1, for balancing individual turbine-wheel stages. In addition to complying with performance tests based on Pratt & Whitney's specifications, these balancers offer fast change-over from one style of rotor to another, low tooling cost, and ample capacity to process all parts and assemblies for the four different models of engines used by United Air Lines.

For vertical balancing, the engine builder requires that the machine be equipped to handle individual stages and have a capacity for balancing parts from 15 to 250 pounds in weight, 40 inches or less at maximum diameter, at balancing speeds up to 750 rpm. The machine must also be capable of operating on 220- or 440-volt, three-



Overhaul of jet-engine rotors requires balancing equipment the equal of that used in manufacturing.

United Air Lines has a team of machines that do a highly accurate job with speed and efficiency

phase, 60-cycle alternating current, wired in accordance with JIC standards. It must be capable, further, of measuring and locating imbalance that can be corrected within a single plane and which will cause vibrations in that plane greater than 0.000050 inch, but not exceeding 3/32 inch at point of attachment of the detector pickup. There is also a requirement for an air-operated draw-bar actuator for expanding or contracting the locating adapters. The latter must have an electrical interlock to prevent accidental release of the adapters during work rotation.

A vertical balancer, designed to meet these basic requirements, is shown in Fig. 1 set up to balance a front-compressor part. A power loading fixture lifts work from the roller conveyor and places it on the locating and driving adapter. A safety clamp device, which fits over the center

Fig. 1. Vertical balancer checks single jet rotor stage during overhaul. For the purpose of photographing the details of the work-piece, the safety clamp was removed. The patented safety clamp normally covers the hub during a balancing operation on Model 25V1.



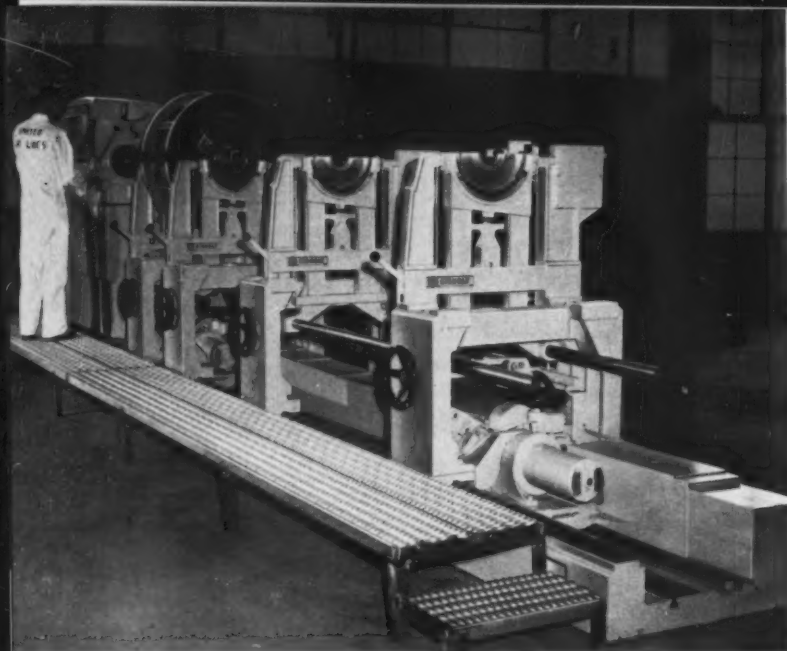


Fig. 2. Horizontal balancer, Model UJP, is arranged to check out a JT3 rear-compressor assembly in its "front" pair of supports.

of the part, has been removed to permit showing work-piece detail, in the illustration.

In a typical cycle the balancer automatically finds and "remembers" the angle of imbalance. It also indicates the degree of imbalance in terms of the correction method to be used. After rotation stops, the operator manually indexes the work-piece until the green console light flashes, indicating that the point on the work where correction should be made is in line with a reference pointer. The operator then selects and fastens in place correction weights totaling the amount noted on the meter. The work is spun again to check the new balance. Total time is only two minutes. Seven stages of a "low" compressor can usually be loaded, balanced, corrected, and finally checked out in less than one hour.

The balancing of compressor- and turbine-rotor assemblies on the Gisholt UJP horizontal machine shown in Fig. 2 is even more exacting. Basically, this apparatus provides an electronic means of quickly and accurately measuring and locating the amount of imbalance. Work is belt-driven. The assembly is supported on precision balance bearings. Tie-bars form a cradle in which the work turns. Spherical bearing seats must be so oriented with the tie-bars as to make alignment of the cradle approach perfection. Adjustment of pillow supports along the tie-bars is easily made on this machine. During test rotation, vibration caused by imbalance is amplified. Electrical compensation is used to eliminate imbalance in any plane which might affect the imbalance reading for any second plane. The read-out meter can be electrically calibrated to indicate the correction value in terms of the method to be used.

The balancer is equipped with a variable-speed

drive. A phototube, triggered by a white register mark on the belt-drive sheave, serves as a reference point for angular location, and it also becomes a tachometer for speed correction, Fig. 3. This feature assures that the work-piece or assembly can be operated at an optimum speed, eliminating deviations that might cause false readings.

Even though individual rotor stage components are balanced separately on the vertical machine, seemingly insignificant errors may accumulate to create vibration. Thus, complete sub-assemblies must be balanced to assure safe operation of the whole assembly. Some weigh as much as 1500 pounds. Special foundations are not required for this balancing machine, although vibrations as small as 0.000007 inch can be located and measured. The machine's capacity ranges between 150 and 1500 pounds. Speeds range up to 600 rpm, with 11-inch diameter cradle-bearing support, 55-inch maximum swing capacity. There is a 75-inch opening between work supports, and a 2-inch thickness of work supports for rotors having swings up to 42 inches in diameter. For safety, the work supports must lock during loading, unloading, starting, and stopping. These requirements are based on "envelope" dimensional projection of all current jet-engine designs, so that one machine handles the entire work range.

Machine sensitivity is such that it will detect a 0.0000145-inch movement of a 1469-pound JT3 front-compressor assembly. However, the balancer can detect a 0.000007-inch imbalance vibration. Here it simplifies one of the most critical problems of jet-engine maintenance—that of replacing supporting ball and roller bearings. New bearings can be installed without a general rebalancing, if an original tolerance of 0.000007

inch is held. Obviously, over-all maintenance costs are thus greatly reduced. The balancer is equipped with an extra-long bed, two complete sets of work supports, and two belt-drive units. Pairs of supports can be individually set up for a given rotor assembly, and associated tooling kept intact, if desired (Fig. 4). In such cases, either set of supports and belt-drive units may be used independently by the flip of a switch. When necessary, any pair of supports can be changed over for a different rotor while the one set is in use. Nonoperating time is thus held to a minimum. Two-machine production is thereby obtained at only one and one-half times the capital cost of a single machine.

The UJP balancer is capable of two-plane balancing or single-plane (static) balancing, with a check for moment imbalance also possible. This flexibility—in addition to improved accuracy, elimination of trial-and-error guesswork, and a reduction in reject rate—permits substantial cost reductions. Here are typical balancing times: high turbine, five minutes; low turbine, one-half to one hour; high compressor, one-half hour; low compressor, one to one and one-half hours. Times include loading, location, measurement, correction, and inspection for balance. With current plans calling for even faster operational speeds at greater altitudes, there can be no compromise with the necessity for precise jet-engine maintenance assembly and balancing to insure higher power-plant reliability and safer operation. This will hold equally true on production in the original manufacturer's plant.

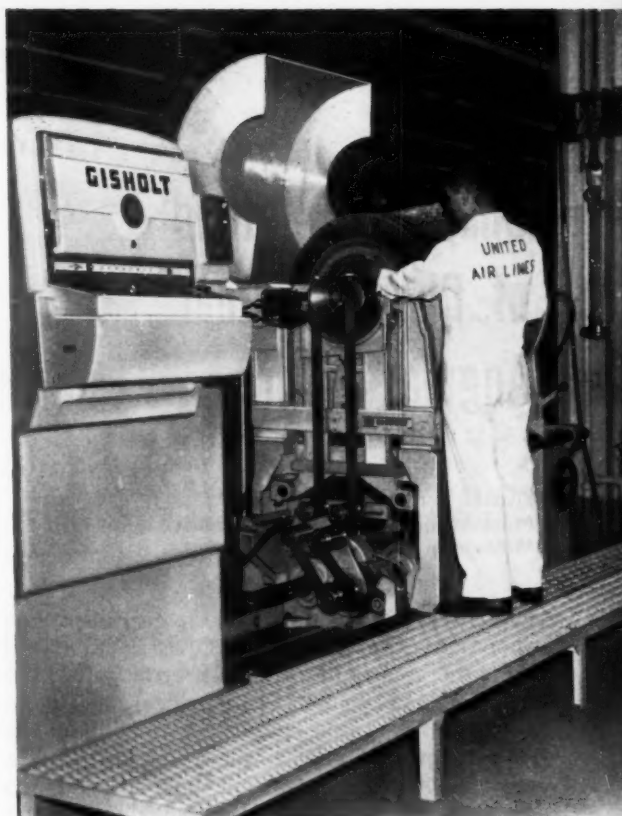


Fig. 3. Compensating slug of a weight automatically specified by the machine is fastened to an indicated correction plane and position on the balance ring machined in the face of the rotor.



Fig. 4. Belt drive arranged on the UJP balancing machine to check a rear compressor for a JT3 jet engine. The machine's scanner appears just above the operator's right shoulder.

Simplified Method of Checking Gear Angular Error

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EXPERIENCE has shown that in gear inspection operations at the Mechanical Division of General Mills the great bulk of angular-error patterns is relatively uniform. As a consequence, a maximum angular error can be established using about ten readings on a gear roll tester. Thus, instead of a separate indexing instrument, angular error can be checked with a small optical polygon mounted directly on the gear mounting arbor (or gear-shaft) of a roll tester (see diagram above), thus eliminating vexing measurement errors created by runout of an indexing spindle, the driver coupling between an indexing spindle and the gear mounting arbor, and skewness between an indexing spindle axis and the gear axis. It should

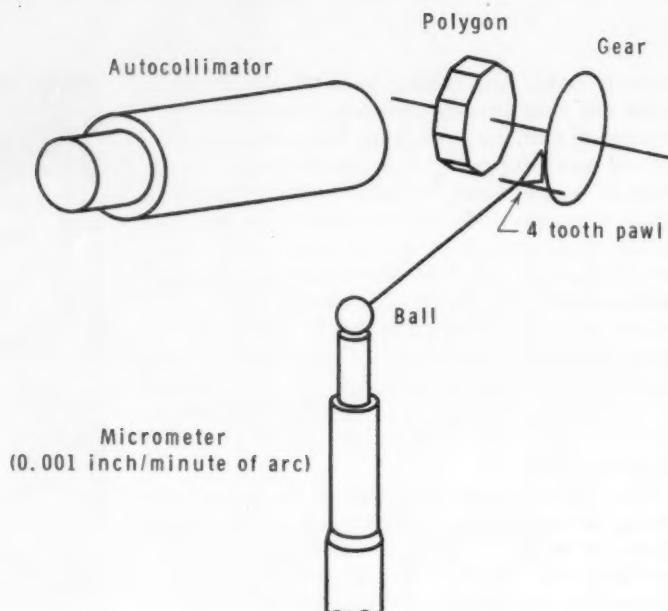


Fig. 1. S&F gear roll-tester setup for checking angular error.



be noted that the polygon mounting is not critical. A decentered polygon introduces no error, and the effect of wobble is usually insignificant.

An S&F gear roll tester, Fig. 1, is ideally suited for checking angular error. The measuring slide of the instrument is set to the proper center distance (the center distance at which the pawl contacts the work gear's inside form radius) and locked. The polygon is mounted on the gear mounting arbor. The gear and pawl are mounted in the roll tester, the micrometer brought to the mid-position, and the auto-collimator is zeroed on a polygon face. To measure angular error, the pawl is rotated out of mesh, then remeshed so as to bring an adjacent face into view. The angular error is then read in the auto-collimator. The friction in the mounting centers is sufficient to keep the driven profiles in contact with the pawl.

In cases where the number of work-gear teeth is not a multiple of the number of polygon faces, a slight pawl rotation (never more than one-half tooth) is necessary. If the number of pawl teeth is not less than forty (on a full circle), the pawl rotation will never exceed plus or minus 4.5 degrees. Over this range, for a suitable arm length, it is usually permissible to use the approximation 0.001 inch per minute of arc in setting the pawl.

If desired, crest-peak readings can be checked for the possibility of excessive crest peaks by comparing changes in micrometer settings against corresponding changes in auto-collimator readings. A side advantage of checking for angular error on a gear roll tester is that erratic readings can be checked for the influence of possible dirt and burrs by simply releasing the measuring slide lock and reading the tooth-to-tooth composite error.

NEW MATERIALS

Paul B. Schubert



The properties and new applications of materials used in the mechanical industries

Plastic-Clad Steel Plate that Can Be Formed or Welded

A plastic-clad steel plate that can be rolled into tanks or pipes, pressed into various shapes for industry, and easily welded has been announced by Lukens Steel Co., Coatesville, Pa. The material can be twisted or bent, and withstands heat at temperatures up to 150 degrees F. and also subfreezing temperatures.

Uses to which this plastic-clad steel plate could be put include piping, storage and processing tanks for salt water, swimming pools, and hull plates for large pleasure craft.

Circle 563 on Readers' Service Card

Fiber-Glass Pad for Vibration Control of Machines

The availability of a vibration-isolation pad using high-density fiber glass has been announced by Consolidated Kinetics Corporation, Columbus, Ohio. Called Kinetic isolation pads, they isolate vibration and eliminate lagging machinery to the floor—without cementing, sawing, or floor drilling.

The pads are furnished in 18- by 18- by 1/2-inch sheets which are prescored at 2-inch inter-

vals for easy cutting to size. The elasticity of the glass fibers provides high internal damping for machine stability. Elimination of chatter in precision machines caused by externally excited vibration can be achieved through its use.

Circle 564 on Readers' Service Card

Transparent Adhesive for Joining Various Materials

"Epoxi-Patch No. 0151" kits can be used to join glass to glass, Pyroceram to glass, metal to glass, and repair printed circuits and strain gages. In use, equal lengths of resin and hardener are squeezed from collapsible tubes and mixed. The name "Reading Clear" is also used to identify this product, which is produced by the Hysol Corporation, Olean, N. Y., as it is very transparent.

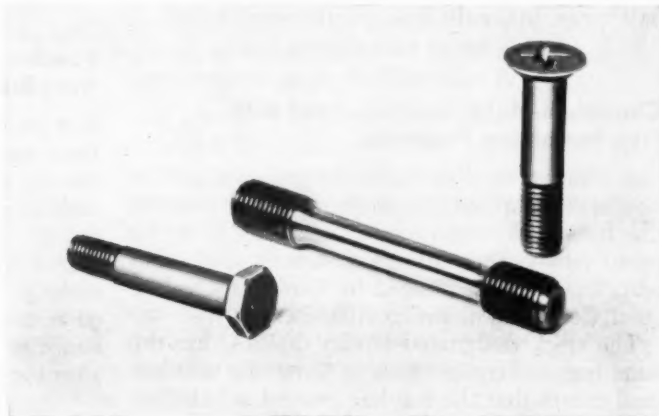
Circle 565 on Readers' Service Card

Two Columbium-Bearing, High-Strength, Low-Alloy Steels Now Available

The availability of two columbium-bearing, high-strength, low-alloy steels, designated Armco High Strength No. 6 and No. 7, with minimum yield points of 50,000 and 45,000 psi, respectively, has been announced by Armco Steel Cor-

These beryllium fasteners, one-fourth the weight of steel but nearly twice as strong as comparable steel fasteners on a strength-to-weight basis, are being offered for satellite and missile applications by Standard Pressed Steel Co., Jenkintown, Pa.

Circle 566 on Readers' Service Card



poration, Middletown, Ohio. These grades are available as plates, hot-rolled sheets, and hot-rolled strip. Their corrosion resistance is equivalent to mild noncopper-bearing steels.

Formability characteristics of these grades facilitate simple bending across the rolling direction, flanging, and light forming operations of the type regularly performed on standard commercial-quality sheet and plate. The No. 6 steel exhibits welding properties similar to those of a 0.20 per cent carbon steel, while the No. 7 steel has properties similar to those of a 0.10 per cent carbon steel.

Sizes available are lengths up to 200 inches for sheets up to 60 inches wide, and 180 inches for sheets from 60 to 72 inches wide. Both grades of this steel can be obtained in the pickled condition if desired.

Circle 567 on Readers' Service Card

High-Strength Thermosetting, Dry-Bonding Film Adhesive Made Available

An elastomer-phenolic, high-strength thermosetting, dry-bonding film adhesive which exceeds military specification MIL-A-5090D for structural bonding and honeycomb sandwich construction has been announced by the Adhesives, Coatings and Sealers Division, Minnesota Mining & Mfg. Co., St. Paul, Minn. Scotch-Weld brand structural film adhesive AF-6, as it is called, provides a uniform adhesive thickness throughout the joint, controlled confinement of adhesive to the immediate bonding area, clean bonding operations, and simple application procedures.

The film adhesive is available in various widths and thicknesses and is designed for use at service temperatures ranging from minus 70 to plus 180 degrees F. It provides metal-to-metal bonds with shear strengths of: 3000 psi at minus 67 degrees F., 3040 psi at 75 degrees F., and 1750 psi at 180 degrees F. Peel strength of this adhesive ranges from 95 to 100 pounds per inch of width. The adhesive resists the effects of water, 20 per cent salt spray, hydraulic fluids, and aromatic fuels.

Circle 568 on Readers' Service Card

Chromium-Nickel Stainless Steel with Free-Machining Properties

A stainless steel in which the proper combination of sulphur and aluminum additions provides the free-machining property enabling it to be made into various fittings, fasteners, and other parts has been announced by Universal-Cyclops Steel Corporation, Bridgeville, Pa.

The steel, designated Uniloy 303MA, has the same nominal composition as Type 303 stainless steel except that the sulphur content is half that

of the 303, and an additional quarter of 1 per cent of chromium and 0.70 per cent of aluminum has been added. Its tensile strength ranges from 95,000 to 100,000 psi; its yielding strength (0.2 per cent offset) ranges from 70,000 to 75,000 psi; and its elongation in 2 inches ranges from 40 to 45 per cent.

The material is available in popular bar sizes in rounds, squares, and hexagons.

Circle 569 on Readers' Service Card

Low-Temperature Fluxless Solder Developed for Aluminum

A fluxless solder, called Tin-A-Lum, which melts at a low temperature has been made available by Metals for Industry, Inc., Jersey City, N. J., for use on aluminum and its alloys, zinc, tin, pewter, magnesium, and other metals. The solder, which is also used to join dissimilar metals, is applied with the aid of a soldering iron or a light flame. It is said to have a tensile strength comparable to that of some welded and brazed joints. The solder has good machinability, can be polished and chromium-plated, and is a good conductor of heat and electricity.

Circle 570 on Readers' Service Card

High-Strength Adhesives for Metal-to-Rubber Bonding

Two products which form an adhesive system which bonds uncured elastomers to any metal and produces a rubber-tearing bond, i.e., where the bond is stronger than the rubber, has been announced by Hughson Chemical Co., Erie, Pa. The system combines the use of "Chemlok" adhesives 220 and 203. In one important application involving the production of rubber grinding and polishing contact wheels and rolls, one coat of 203 is used as primer and one coat of 220 as an adhesive for stainless-steel or aluminum hubs.

Circle 571 on Readers' Service Card

Powder for Stripping Nickel from Brass and Copper

A powder for immersion-stripping nickel from brass and copper has been announced by MacDermid Inc., Waterbury, Conn. Called Metex nickel stripper BR, the product provides a safe, fast, economical method of reclaiming nickel-plated copper-base alloys and copper-plated die castings. Little or no buffing is required before parts can be replated. It is said that no maintenance or activator additions are required, even after the bath has been standing for long periods.

Circle 572 on Readers' Service Card

Water-Soluble Base for Machining and Grinding Aluminum

A base which is a combination of emulsifiers, surface actives, and oiliness agents in a mineral oil blend has been developed by Baker/Gubbins Co., Detroit, Mich., to sink aluminum chips and prevent caking of aluminum fines. The base, called B/G No. 505, is a greenish-cast transparent oil which makes a stable white emulsion in water and has high resistance to bacterial growth. It is used in a dilution range of from twenty up to ninety parts of water to one part of base.

Circle 573 on Readers' Service Card

Bright-Finish Low-Temperature Brazing Alloy for Joining Copper Alloys

A low-temperature phosphor-copper silver-brazing rod called All-State Bright Finish No. 23, which can be used to produce 50,000-psi tensile-strength bonds with 25 per cent elongation and 1260-degree F. working temperature, has been announced by All-State Welding Alloys Co., Inc., White Plains, N. Y. The silver-brazing alloy is recommended for joining all copper alloys and can replace more expensive high-analysis silver-brazing alloys while maintaining comparative strength, elongation, and high corrosion resistance. It can be applied by all standard brazing methods.

The alloy is available in 1/16-, 3/32-, 1/8-, 3/16-, and 1/4-inch rods 18 inches long and 0.050- by 1/8-inch strip.

Circle 574 on Readers' Service Card

Corrosion-Resistant Aluminum Paint for Use at 1200 Degrees F.

A high-heat resistant aluminum paint that is said to set to the touch in two hours and air dry in six hours without baking has been announced by Speco, Inc., Cleveland, Ohio. Heat-Rem H-120A, as it is called, has a silicone-resin base and can be applied by dip, spray, or brush. It resists atmospheric exposure and the corrosive effects of acids and alkalies.

Circle 575 on Readers' Service Card

Elastomer that Withstands Wear and Torque Loads

A material that outwears rubber and withstands torque load has been developed by Shurclose Seal Co., Detroit, Mich. Called Elastine, the material was designed specifically for flexible coupling inserts, but since that time many diversified uses have been found.

Circle 576 on Readers' Service Card



Coverage of weld splatters, edges, and other uneven surfaces at left can be obtained by the use of the metal primer Clo-Flex 621. Coverage shown at right is typical of that obtained with other chlorinated materials and epoxies.

Metal Primer that Covers Sharp Edges and Protuberances

A metal primer that provides coverage to all metal surfaces—particularly over weldments, sharp edges, and other protuberances—is now being produced by Harrington Paint Co., Inc., East Cleveland, Ohio. This primer, called Clo-Flex 621, is said to be compatible with practically all finish coatings. It is impervious to salt and chemical attack, and is abrasion and chip resistant. No color change was noted following exposure to such compounds as 5 per cent nitric acid, 50 per cent sulphuric acid, and 5 per cent hydrochloric acid. The primer dries to a tack-free finish in fifteen minutes under average ambient temperature and humidity conditions. It can, however, be force-dried in three to five minutes.

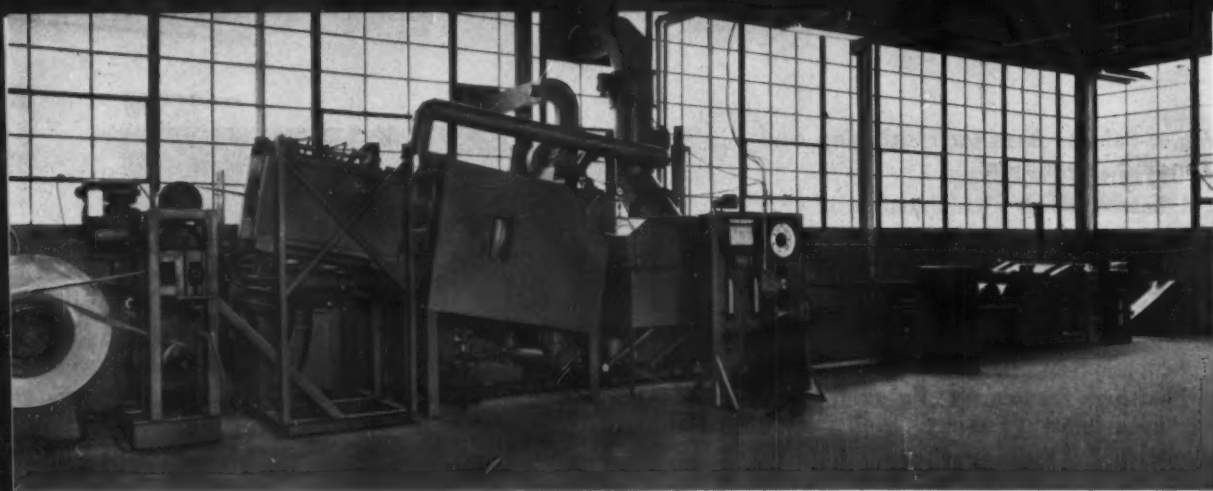
The material is said to have an indefinite pot life; is suitable for primer uses on most metals; and has been used for coating rubber, wood, and other materials as well.

Circle 577 on Readers' Service Card

Bearing-Retainer Material for Use at Temperatures up to 800 Degrees F.

An alloyed-iron material for roller-bearing retainers has been announced by the Rollway Bearing Co., Inc., Syracuse, N. Y. Known as Rollube, the material can be used for service at temperatures up to 800 degrees F., has a coefficient of expansion very close to that of steel, and will operate very satisfactorily under conditions of boundary lubrication. It is now being used as the standard retainer material for many of the company's thrust and radial bearings.

Circle 578 on Readers' Service Card



Molten Salt Jet-Sprayed for Cleaning Steel

A JET-SPRAY PROCESS for applying molten salt to clean continuously moving steel strip, without any possibility of scratching the steel, has been developed by the Kolene Corporation, Detroit, Mich. Because of the finishes now specified for automotive trim, appliance components, and architectural parts, this process will have particular importance in the descaling of stainless-steel strip. The advantages of the jet-spray process can now be added to those of the regular Kolene salt bath, such as complete scale removal, short acid rinse, low metal loss during brightening, and high strip speed. Kolene No. 1 converts the annealing oxides into soluble oxides that are removed easily in the electrolytic acid pickle.

So that potential customers can see the results of the new process, a fully operational pilot-model jet-spray line has been installed in the Kolene plant. This line, which is shown in Fig. 1, is representative of the requirements for a typical steel-mill operation.

In production the steel strip leaves the annealing furnace, passes between the jet-spray heads, and goes through a rinse tank and pickle bath as indicated in Fig. 2. It then passes through a con-

ventional brushing station and a radiant heater and blowing station where it is dried by blasts of heated air. The strip is then coiled. All speeds, concentrations, quantities, and temperatures are individually adjustable.

Aside from size, the biggest difference between the pilot line and a production line is in the furnace design. In the pilot line, previously annealed strip is heated to the correct temperature in a direct-gas-fired semiclosed furnace. Annealing scale must already have formed on the strip before it is run through the line.

Rubber rolls guide and maintain tension on the steel strip except in the acid-pickle and hot-water rinse stages. Here, neoprene-covered steel rolls are used to resist acid action.

According to the concern, comparative over-all economics of spray and bath processes are difficult to establish. First of all, space requirements and equipment needs are different. Salt consumption is not quite the same. Capital and operating charges are proportioned differently for the two processes. According to Kolene executives, however, there is no question but that for stainless steel the jet-spray process is the more practical.

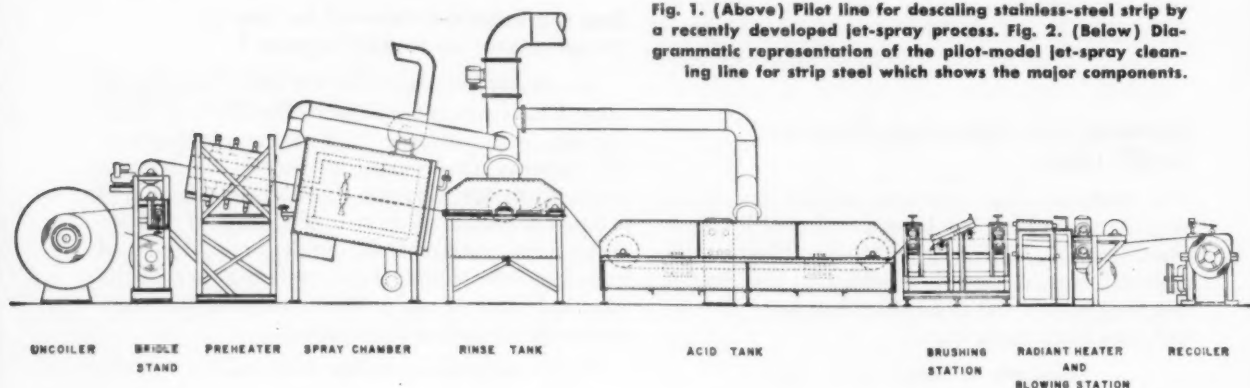


Fig. 1. (Above) Pilot line for descaling stainless-steel strip by a recently developed jet-spray process. Fig. 2. (Below) Diagrammatic representation of the pilot-model jet-spray cleaning line for strip steel which shows the major components.

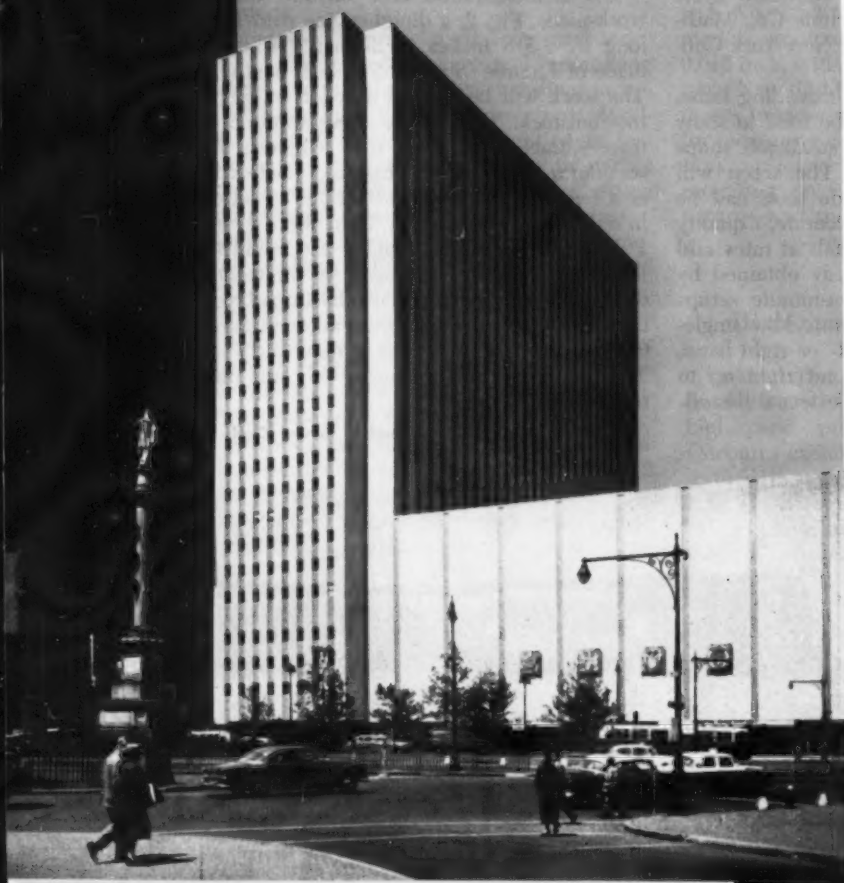
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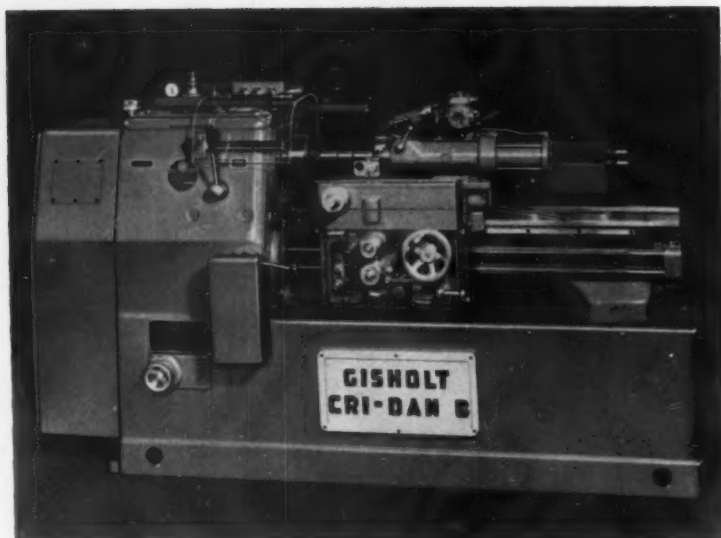
New York



CREATIVE manufacturing equipment valued at over \$12,000,000 will be exhibited at the coming exposition and convention of the American Society of Tool and Manufacturing Engineers. The events will take place at the Coliseum in New York City from May 22 to 26, inclusive. Fifty technical papers will be presented at seventeen sessions of the convention. They will deal with such subjects as new techniques for material removal, numerical control, high-energy-rate forming, cutting-tool materials, operations research, work simplification, and manufacturing systems management. The following pages show some of the products to be exhibited for the first time.

NEW MACHINERY AT THE SHOW

Fig. 1. Cri-Dan automatic lathe to be demonstrated by the Gisholt Machine Co.



Gisholt Automatic Threading and Tracing Lathe

Booth 2537

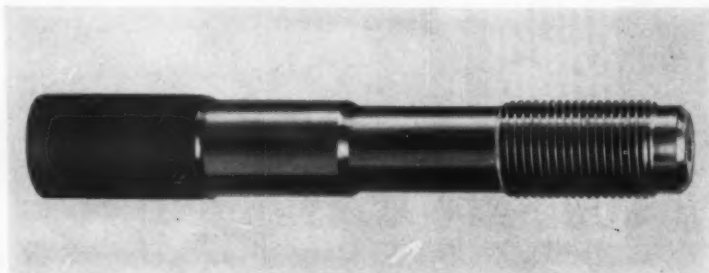
Tracing and threading in one fast automatic cycle will be featured by the Gisholt Machine Co., Madison, Wis., at the ASTME Exposition, New York Coliseum, New York City, May 22-26.

A Gisholt Cri-Dan "B" automatic threading lathe, Fig. 1, equipped with a tracer will be used to show how threading costs can be cut in small job shops as well as high-production plants. The setup will demonstrate how single-point carbide tools can be employed to produce highly accurate, quality threads and fine finishes in all materials at rates said to be much faster than any previously obtained by other methods. Fast eight- to fifteen-minute setups will be made on request to demonstrate how single- or multiple-start, coarse or fine, left- or right-hand, straight or tapered threads can be cut right up to shoulders on all types of internal or external threading work in a wide range of sizes.

The demonstration will include machining the work-piece, Fig. 2, a diesel-engine stud 10 1/4 inches long by 1 5/8 inches in diameter. These studs are made of LaSalle "Stressproof" steel bars with copper. The work will be held in a collet and supported by the tailstock. During the demonstration cycle, the tracer attachment at the rear will turn the stepped sections to their correct outside diameters in one pass at a feed of 0.008 inch and surface speed of 580 fpm in only fifty-four seconds. Then the 2 1/4-inch long, 1 1/2-inch diameter, single-start, eight-thread-per-inch thread will be produced by the front threading slide. The single-point carbide threading tool will complete the thread in twenty automatic passes (with 0.004-inch infeed per pass) in only thirty-six seconds. The total floor-to-floor time is only one minute forty seconds.

Circle 573 on Readers' Service Card

Fig. 2. Diesel-engine stud machined on the Gisholt lathe shown in Fig. 1



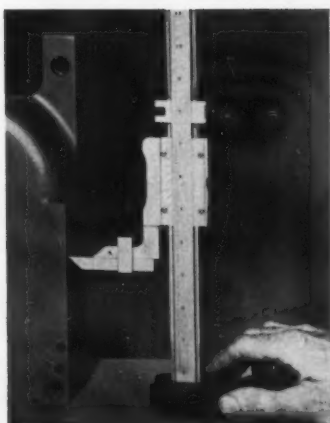


Fig. 1. Starrett light Master vernier height gage



Fig. 2. Short half-base micrometer depth gage



Fig. 3. Starrett Dial-Master precision indicator

Starrett to Exhibit New Precision Instruments and Measuring Tools

Booth 1214

The L. S. Starrett Co., Athol, Mass., will include in its exhibit many new additions to its line of mechanics hand measuring tools and precision instruments, steel tapes, steel rules, dial indicators, dial gages, hacksaws, hole saws, band saws, and precision die and flat stock.

Among the important new tools is a new series of "Master" vernier height gages, Fig. 1, combining correct balance and weight for easy handling in applications where a lighter gage is preferred. Available in 12- and 18-inch sizes, these height gages feature a new, long, fifty-division vernier with widely spaced, easy-to-read graduations to simplify setting and reading without the aid of a magnifying glass.

Other features include: no-glare "Satin-Chrome" finish on all reading surfaces, master bar hardened and stabilized for rigidity and lasting accuracy, combination straight and angular ways for positive alignment of bar and slide, extra-long slide for greater bearing surface, natural hand-grip hand fitting base, natural-grip hand fitting base; and cut-away base for full-range, direct reading from base.

Also to be shown will be a new series of micrometer depth gages featuring a short half-base, Fig. 2, designed to facilitate measuring depths of holes and slots located close to shoulders or between obstructions where full-base gages cannot be used. Graduated to read in thousandths of an inch, these gages are available in three sizes—0 to 3, 0 to 6, and 0 to 9 inches.

Also to be shown are three new superprecision dial indicators, including a Starrett "Dial-Master" No. 25-106, Fig. 3, with an accuracy of plus or minus 0.00001 inch. It is designed for applications requiring extreme precision, such as laboratory work or shop

inspection to laboratory standards. This new dial indicator has widely spaced graduations which read in 0.00005 inch, with the dial reading 0.0015-0-0.0015 for a total range of 0.003 inch.

Other superprecision dial indicators are No. 25-109 and No. 25-209, balanced and continuous-reading models, graduated to 0.00005 inch with a range of 0.015 inch, with an accuracy of plus or minus 0.00005 inch. New disc type micrometers for measuring thicknesses in close quarters; new blade type micrometers for measuring depths or diameters in narrow grooves, slots, etc.; and new micrometer heads designed for mounting on electronic equipment, machine tools, fixtures, and special gages will also be displayed.

Circle 574 on Readers' Service Card

High-Speed Variable-Stroke Presses

Booth 3801

Dechert Dynamics Corporation, Palmyra, Pa., will display a model of its new line of Zeh & Hahnemann high-speed presses. This machine incorporates Dechert's exclusive Varistroke feature, which enables it to deliver strokes of four different lengths, and thus permits a much wider work range.

The press, which also features a newly designed gap frame, contains a frame-mounted Dechert Zeh Flex air-clutch mechanism designed to assure trouble-free operation by reducing wear on the crankshaft. While this new line of presses is available in sizes ranging from 5 to 150 tons, the one exhibited at the Coliseum will be a 12-ton open-back model. This line has been developed in conformance with JIC specifications.

Circle 575 on Readers' Service Card

NEW MACHINERY AT THE SHOW

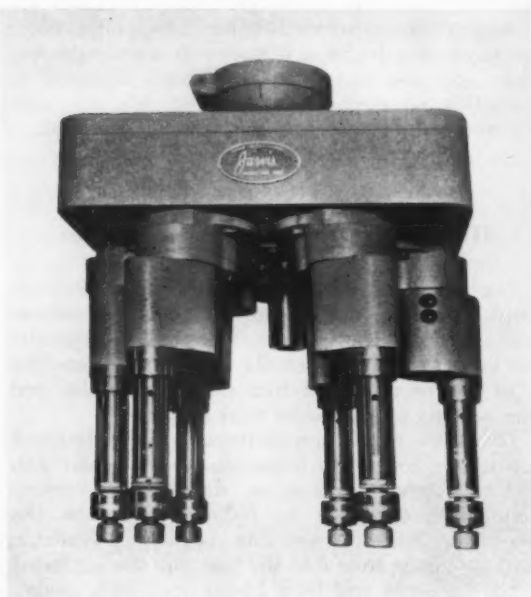
Jarvis to Exhibit New Tools and Attachments

Booths 1322 and 3219

The Jarvis Corporation, Middletown, Conn., will have on display, at Booth 1322, machine tools and attachments, as well as high-speed-steel taps. At Booth 3219, several new products will be shown for the first time, together with carbide tools. Among the products will be an extra-light-duty, compact adjustable drilling and tapping head. The new head is a gear-driven double-eccentric type and is offered as standard with two to six spindles. Minimum center distance on the two-spindle head is 5/8 inch, with a 1-inch minimum for the four-spindle unit. The new head is designed for use on bench type drill presses as well as floor models.

Added to the other end of the line is a new, extra-heavy-duty adjustable head of the same basic design with a 1-inch diameter drill capacity made with two to six spindles. A six-spindle model is shown in the illustration.

This six-spindle head, the heaviest of the adjustable group, is designed for applications where work patterns are varied and heavy-duty drilling capacities are necessary. Featured as the most important new addition being introduced is the Jarvis Dril-King, a floor type, self-contained universal-joint drilling and tapping machine designed for light-duty applications. Some of the features of this unit are: 6- by 8-inch work area; twelve spindle drivers; minimum center distances of 5/16 inch; four speed selections; and T-track vertical feed table.



Six-spindle adjustable drilling and tapping head introduced by Jarvis Corporation

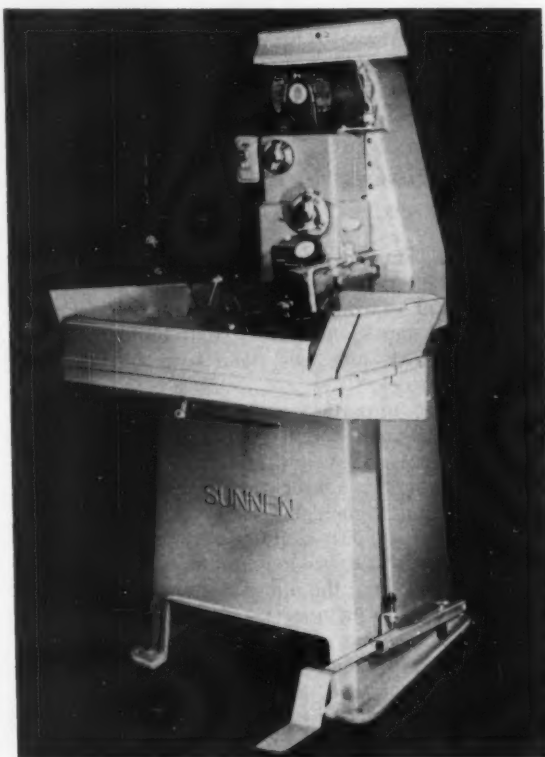
In addition to standard adjustable-arm assemblies, accurately jig-bored cluster plates for very-close-tolerance work will be in operation at Booth 1322.

Circle 576 on Readers' Service Card

Sunnen to Demonstrate Honing Machine

Booth 1515

The Sunnen Products Co., St. Louis, Mo., will feature actual working demonstrations of a new, versatile honing machine. This heavy-duty machine has a wide range of easy-to-select spindle speeds and a double-reduction belt drive that delivers full power from a 1/2-hp motor to the spindle at all operating



Heavy-duty honing machine with wide speed range introduced by Sunnen Products Co.

speeds. This drive is fully enclosed to promote safety, improve appearance, and insure a long life of trouble-free service. An additional control permits sensitive adjustment of stone-cutting pressure.

The machine is said to be able to handle any honing applications on 0.100-inch to 2.625-inch bores with standard tooling available from stock. Bores up to 5.500 inches can also be honed with tooling built to order.

Circle 577 on Readers' Service Card

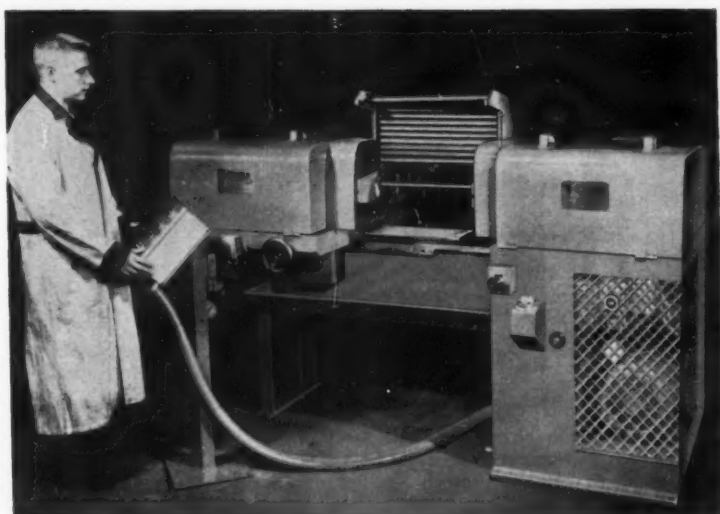


Fig. 1. (Left) Pines double-end tube and pipe end-finishing machine

Fig. 2. (Below) Hi-Speed bending press to be demonstrated by Pines Engineering Co., Inc.

Pines to Exhibit End-Finishing, Bending, and End-Spinning Equipment

Booth 2019

Simultaneous deburring, chamfering, and facing of both ends of 1-inch diameter tubing at rates up to 3000 ends an hour will be demonstrated on the Model 666 double-end finishing machine, Fig. 1, to be exhibited for the first time by Pines Engineering Co., Inc., Aurora, Ill. A Model 660 machine (not illustrated) will also be shown end-spinning attractive, permanent closures in aluminum tubing at speeds of 400 to 500 ends an hour, representing a cost reduction of 85 per cent over metal or plastic caps. Progressive bending at rates up to three times faster than on conventional equipment will be demonstrated on the Pines Model 3-T Hi-Speed bending press, Fig. 2.

The high-production, automatic Model 666 double-end machine, Fig. 1, holds work-piece length accuracy within 0.005 inch. It handles double-end finishing operations on tube, rod, and pipe in diameters from 1/2 inch minimum to 3 inches maximum. The standard-bed machine accommodates lengths from 2 1/2 to 60 inches. Lengths up to 120 inches are handled by the extended-bed machine. End-to-end tolerances are consistently held within 0.005 inch on a production basis. Typical production rates range from 2400 to 3000 ends (1200 to 1500 finished parts) an hour. Work-pieces are automatically fed into machining position by the hydraulically operated Chute-Matic feed mechanism.

The Model 3-T Hi-Speed bending press, Fig. 2, will be set up and in operation, producing a typical frame section for metal furniture. Unusually compact, this machine requires only 10 square feet of floor space, yet is said to produce bends up to three times faster than conventional equipment—typical output speeds average up to 1500 bends an hour. Good-quality bends are produced in work up to 1-

inch outside diameter in 16-gage (0.065-inch) wall steel tubing or its equivalent.

The bending press is completely self-contained and hydraulically operated, powered by a 15-hp motor. Progressive bending of up to ten different angles is achieved automatically.

Circle 578 on Readers' Service Card



NEW MACHINERY AT THE SHOW

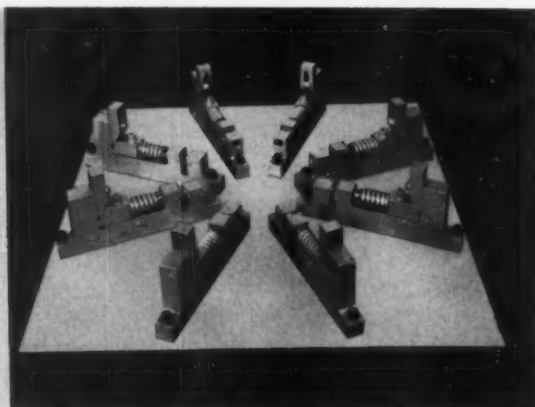
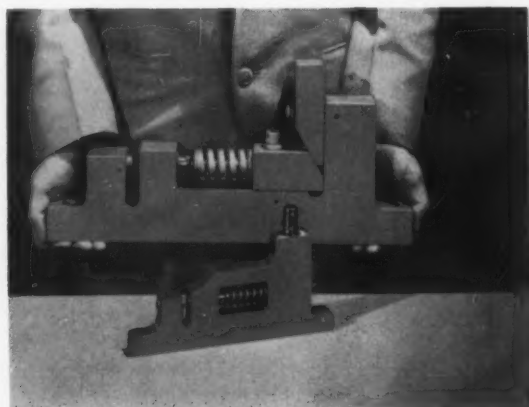


Fig. 1. (Left) Largest and smallest sizes available in the new line of Unipunch Series HZ hole-punching units. Fig. 2. (Right) Typical template setup of Unipunch Series HZ hole-punching units, ready to punch holes in vertical sides of round container with one stroke of ram

Unipunch Hole-Punching Units and Punch-and-Die Sharpener

Booth 1532

The Punch Products Corporation Buffalo, N. Y., will introduce for the first time its complete line of Unipunch Series "HZ" horizontal hole-punching units and the Unipunch universal punch-and-die sharpener. The new hole-punching units, Figs. 1 and 2, are designed for punching round and shaped holes in flanges of angles and other formed parts. The punch travels horizontally, and the die, stripper spring, lifter spring, and guide are located in a horizontal position in the holder. Punches, dies, guides, and springs are the same as the standard low-cost parts used in the manufacturer's Unipunch Series "A" hole-punching units which operate in the conventional vertical direction. Nothing is attached to the press ram. The holders of these completely self-contained units accurately align punches and dies.

In operation, the press ram depresses a wedge-shape vertical plunger to move the beveled punch-block against the punch-head. In this way the punch horizontally pierces the work. By setting up a group of these hole-punching units on a template, round

and shaped holes can be punched in all vertical sides of a box at each stroke of the press ram. Pilot-pins extending below the holder base accurately locate these units on a drilled mounting template. These Unipunch Series HZ hole-punching units are available in a complete range of holder widths up to 2 inches for punching up to 1/4-inch mild steel. Maximum hole diameter is 0.875 inch.

The new portable, bench type Unipunch universal punch-and-die sharpener, Fig. 3, is equipped with a built-in universal fixture to provide a handy, convenient, economical method for sharpening punches and dies. This sharpener accepts most makes and types of standard and special punches and dies. It eliminates the need for specially trained operators; releases expensive surface grinders; and can be used on the maintenance bench and in the tool crib, as well as the toolroom. Outstanding features include: convenient handle for swinging punches and dies across grinding wheel, punches and dies that are held securely in precision-machined V-holder at 90

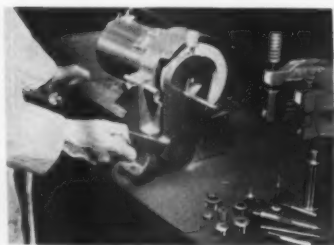


Fig. 3. Unipunch universal punch-and-die sharpener, with operator turning knurled feed handle for precision-feeding punches and dies to grinding wheel surface

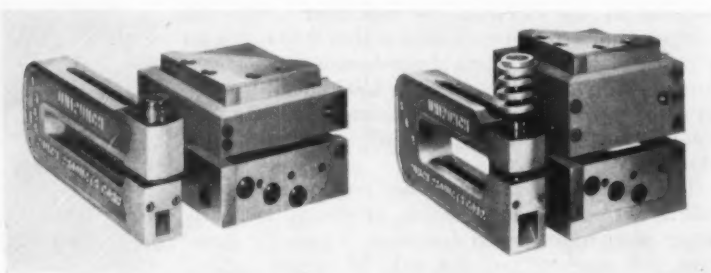


Fig. 4. (Left) Typical Unipunch Series A hole-punching and notching units. Fig. 5. (Right) Typical Unipunch Series B hole-punching and notching units

Fig. 6. Unipunch air-hydraulic press equipped with unitized tooling and gaging fixture



degrees to the grinding wheel, knurled feed handle that provides precision feeding of punches and dies to grinding wheel, graduations in increments of 0.005 inch scribed on handle hub for accurate control of feeding, oil-impregnated precision bronze bearings that provide easy swing handle movement and feed operations for years of close-tolerance performance, special formulated cup type grinding wheel, rigid one-piece cast frame, and grinding-wheel guard. The totally enclosed, fan-cooled, 1/2-hp end-mounted motor is permanently lubricated to provide years of maintenance-free operation plus extra-long bearing life. The motor operates at 3450 rpm on 115-volt, 60-cycle current.

Punch Products Corporation will also exhibit their complete line of Unipunch Series "A" and "B" hole-punching and notching units, Figs. 4 and 5, with popular standard 8 3/8-inch shut height, 3 1/2-inch die height, 5 1/2-inch shut height, and 2 19/32-inch die height, respectively. Series A hole-punching units punch up to 3-inch round and shaped holes in up to 1/4-inch thick mild steel. Series B punch up to 3 1/2-inch round and shaped holes in up to 1/8-inch thick mild steel. With the Unipunch tooling system, custom setups made with these standard Series A and B units will punch and notch angles, channels, extrusions, plates, and sheets. Simply set up units outside the press, slide onto press bed, and produce parts with first stroke of ram. There is no press down time—nothing attached to press ram—and no special capital equipment.

Also to be exhibited in operation will be the Unipunch 10-ton air-hydraulic press, Fig. 6, equipped with Unipunch unitized tooling—ideal for low or medium production runs and experimental work. Interchangeable tooling is designed to reduce tooling costs to a minimum for single or series hole punching. Standard Unipunch notching units may be used in this Unipunch Model 1012 press for parts requiring corner, edge, vee, and specially shaped notches. This press is available complete with gaging.

Circle 579 on Readers' Service Card

Osborn to Exhibit New Finishing Machine

Booth 2407

A finishing machine for high-production deburring, edge-blending, surface-cleaning, polishing, and buffing applications will be exhibited by Osborn Mfg. Co., Cleveland, Ohio. This machine, designated the 5224-MIA, consists of a two-spindle indexing workholder and one universal finishing wheel-head. Simplicity of design adapts it for either job-shop or continuous production runs.

The two-spindle work-holder requires inexpensive fixturing, while the MIA finishing head is engineered for extreme versatility. Major setup adjustments are built-in to achieve any compound angle for positioning of the finishing wheel. During high-production runs, the operator performs the unload and load operation on one spindle while the gear or part on the other spindle is being deburred or finished.

Circle 580 on Readers' Service Card

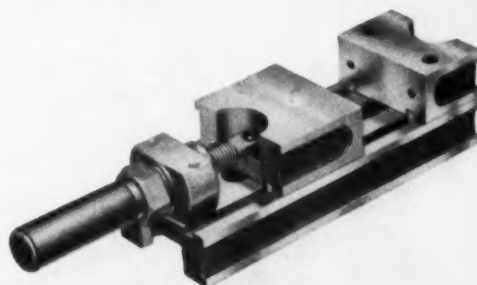
Producto Precision Grinding Vise

Booth 2450

The Toolroom Equipment Division of Producto Machine Co., Bridgeport, Conn., is introducing a precision vise specially designed to grind surfaces square in two planes without removing the part. This vise is especially adapted for use in electrical-discharge machining, particularly where several identical cavities require accurate electrode-to-edge positioning and where the piece-part to be worked on is small and difficult to clamp.

The vise can be disassembled quickly and all components can be ground simultaneously to restore original accuracy when worn through long use. The clamping flange, with both sides finished for clamping, has a body length of 10 3/8 inches, a width of 3 1/2 inches, and depth of 1 1/2 inches. The jaw-opening range is 0 to 3 1/2 inches. Over-all length is 14 1/2 inches; over-all height, 3 inches; and weight, 19 pounds.

Circle 581 on Readers' Service Card

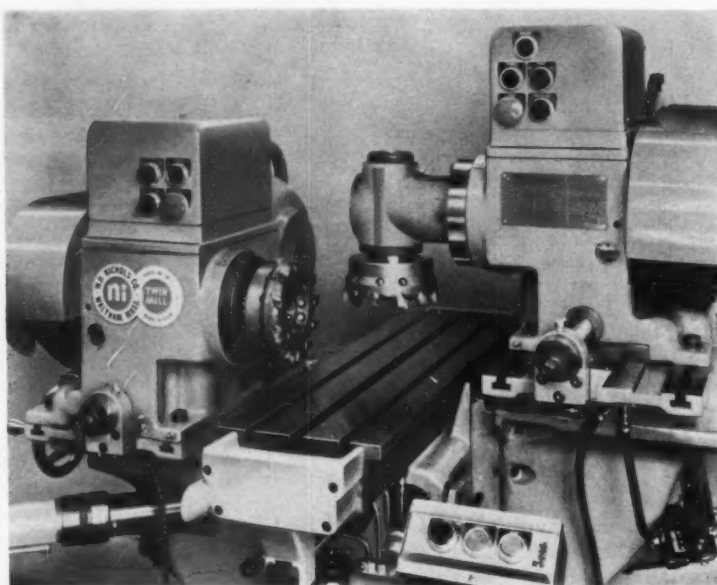


Precision grinding vise built by Producto Machine Co.

NEW MACHINERY AT THE SHOW

Fig. 1. (Right) Nichols Twin Mill with both horizontal and vertical milling heads

Fig. 2. (Below) Nichols semiautomatic production miller



Nichols "Twin Mills" and Semiautomatic Production Millers

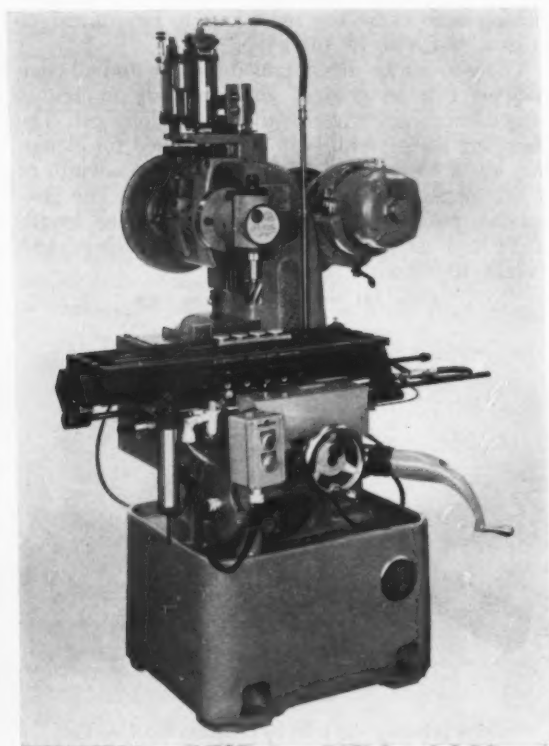
Booth 1128

The W. H. Nichols Co., through its national distributor, Rem Sales, Inc., West Hartford, Conn., will show the latest versions of its "Twin Mills" and semiautomatic production millers. Fig. 1 shows a Twin

Mill with both horizontal and vertical milling heads, suitable for the precise face milling of two right-angular surfaces at one pass of the table. The machines exhibited will incorporate new features, including a mist-coolant system, arbor-mounted cutting arrangements with outboard arbor support, air-actuated work-holding fixture, automatic rough- and finish-milling cycles, and other advanced improvements.

Fig. 2 shows a Model 8SA semiautomatic production miller having both automatic rise-and-fall spindle cycle and automatic table feed. Machines of this type will be exhibited in two sizes, with a variety of rise-and-fall spindle motions synchronized with automatic table movements. A "skip-milling" demonstration will show how widely separated surfaces can be milled at one setting, with rapid traverse between cutting positions to avoid "milling air." A broad range of typical milled parts and milling accessories will round out the exhibit.

Circle 582 on Readers' Service Card



Light-Wave Micrometer

The Van Keuren Co., Watertown, Mass., is introducing a Model LWM-60 light-wave micrometer. This precise measuring instrument reads directly on the handwheel to 0.00010 inch and on the vernier to 0.00001 inch (ten millionths of an inch). It has a capacity of 0 to 2 inches, and is simple to use. An unskilled operator can easily learn to duplicate readings with accuracy. The compact, complete unit requires no gage blocks and need not be used as a comparator. The measuring instrument "incorporates

the accuracy of a light wave pressure indicator and provides the highest accuracy of screw micrometers." (Handbook 77—National Bureau of Standards)

Designed as an inspection standard, this instrument instantly and directly measures basic standards, plug gages, measuring wires, and setting blocks. It also checks roundness of cylindrical shapes, measures pitch diameter of threads and gears, and is especially useful in maintaining quality control of purchased parts and gages.

With this instrument, manufacturing departments can stop work spoilage at the source and assure



Light-wave micrometer introduced by Van Keuren Co.

quality control in the production stage—at the screw machine, grinder, or lapping machine. It can be used at assembly for fast, accurate checking of components before, during, and after assembly and for grading parts for selective fit assemblies.

Circle 583 on Readers' Service Card

Austin Industrial Corporation to Exhibit Grinding, Boring, and Milling Equipment

The Austin Industrial Corporation, White Plains, N. Y., will exhibit for the first time an MSO cylindrical grinder, Model FH-100, of the design shown in the accompanying illustration. Other MSO equipment to be exhibited will include a production grinder, Model FH-200/750, which has a capacity of 10 by 30 inches and is arranged for automatic cycling, providing selection of plunge-cut movement, rough and finishing feed, variable spark-out period, table traverse, work-head rotation, coolant flow, and rapid wheel-head retraction with automatic switch-off of all components upon completion of cycle.

MSO electrohydraulic cylindrical grinder, Model FH-100, introduced by Austin Industrial Corporation

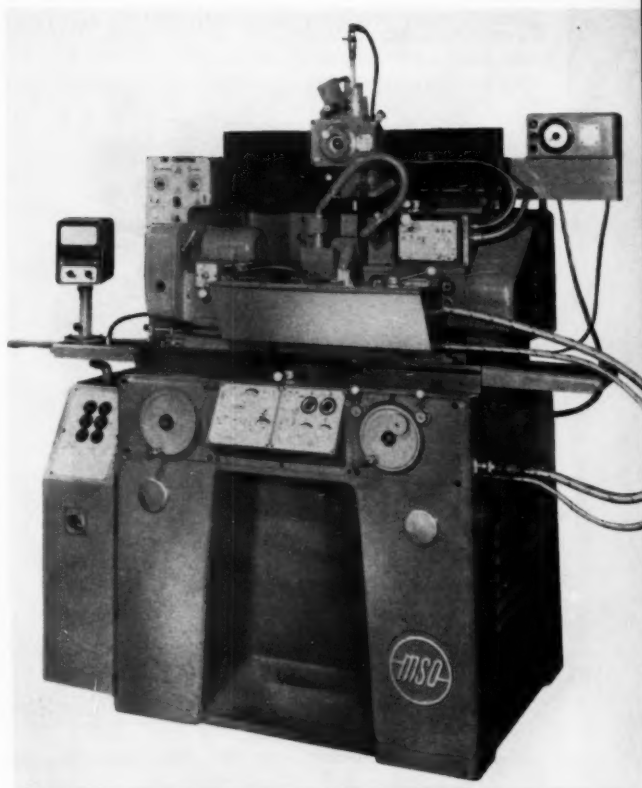
An MSO universal grinder, Model FMES, with a capacity of 7 by 12 inches with compound swivel wheel-head, roller guides for wheel-head infeed insuring maximum sensitivity, and fine infeed of 0.00005 inch, equipped for external and internal grinding, will be demonstrated.

A Model PFRL optical coordinate jig borer will also be on display. The table capacity of this borer is 33 1/2 by 18 3/4 inches, with Leitz optics allowing zero positioning of table at any point of movement. Provision is made for direct reading in any direction of the coordinates with a setting accuracy of 0.000020 inch.

Austin will also exhibit three Sajo machines, including a universal miller, Model 52, with toolmaker's overarm; a No. 2 vertical miller, Model 54; and a production miller, Model APF-54.

The MSO electrohydraulic cylindrical grinder, Model FH-100, shown in the illustration with electrohydraulic servo control, has been designed for production grinding of ultraprecision parts. The capacity of this machine is 3 1/2 by 12 inches. It is available either as a plain or universal grinder. Exceptional flexibility and ease of setup and operation makes this grinder equally efficient on short- and long-run jobs.

In addition to manual operation, provision is made for automatic cycling with rapid advance of wheel-head, rough and finish feeds at predetermined rates,



NEW MACHINERY AT THE SHOW

and variable spark-out period. Automatic cycling also includes: rapid retraction of wheel-head; synchronization of work-head and wheel-spindle rotation; table traverse and coolant flow; and automatic switch-off of all components upon completion of the cycle. The combination of servo motors and magnetic valves controlled by potentiometers results in ultra-precise setting of table and wheel-head feed rates.

For maximum simplicity and speed, all motions involved in the grinding cycle are "dialed in" on the control panel located at the front of the machine. Separate hydraulic circuits are provided for the wheel-head and table movements.

Optionally, the FH-100 grinder can be supplied with automatic electrical or electronic measuring

devices, automatic dressing attachments, and Constator unit. All electrical and hydraulic controls are included as original equipment to allow future installation of these accessories in the field.

The Constator unit is an especially noteworthy optional feature. This unit, automatically and independent of the operator, compensates for any variations in temperature and in viscosity of the hydraulic oil during the working day. It maintains wheel-head movements constant at the values preset on the control panel and insures repetitive accuracy and uniformity of the work ground within 0.000050 inch. If desired, all hydraulic and electrical controls can be operated separately.

Circle 584 on Readers' Service Card

Sheffield Unveils New Inspection Instruments

Booth 1414

The Sheffield Corporation, subsidiary of Bendix Corporation, Dayton, Ohio, will demonstrate a Ferranti FI-22 measuring machine, Fig. 1, designed for fast, precise measuring of the location of holes and surfaces of parts in two dimensions. It displays the X- and Y-coordinate readings simultaneously by means of lighted numerals on the panel above the gage table.

Gaging accuracy obtained over the 15- to 24-inch range is better than 0.001 inch. The instrument can be used also for layout and scribing operations; to center punch precision parts with highest accuracy;

and, through the use of Sheffield air or electronic gage cartridges or a toolmaker's microscope, to handle a large variety of inspection problems. The workpiece is simply positioned on the table, and the movement of the gage probe from reference position through X and Y coordinates is read on the digital panels.

Another new instrument to be demonstrated publicly for the first time is the Precisionaire noncontact thickness gage, Fig. 2. This gage measures the thickness of thin, fragile materials, such as semiconductor wafers and dice of germanium and silicon, without

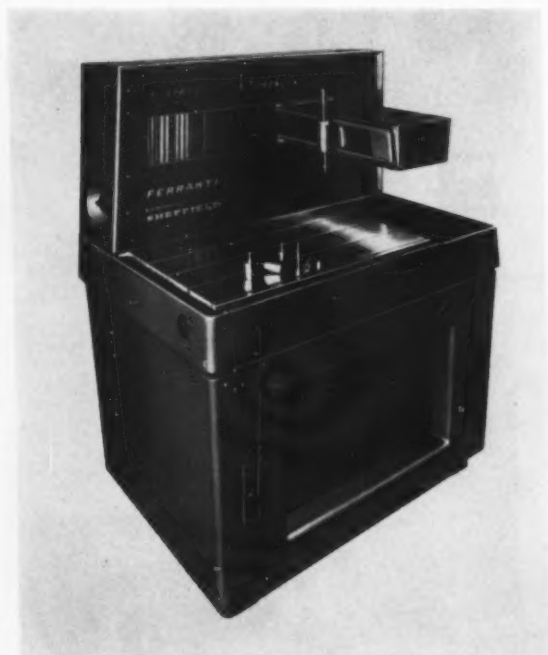


Fig. 1. Ferranti measuring machine to be demonstrated by Sheffield Corporation

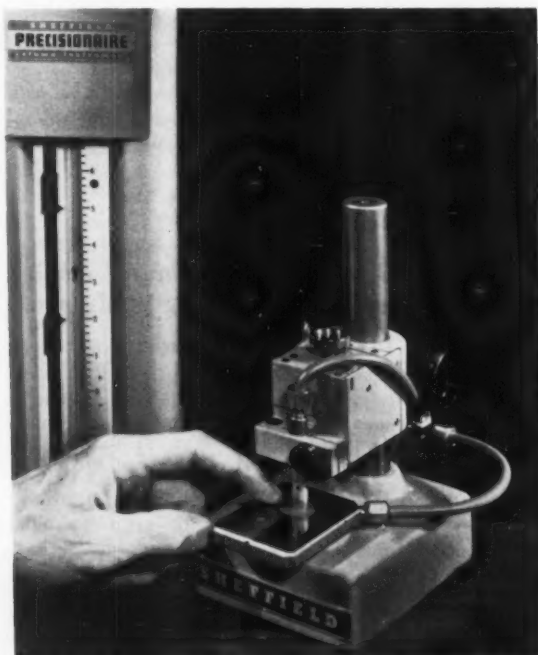
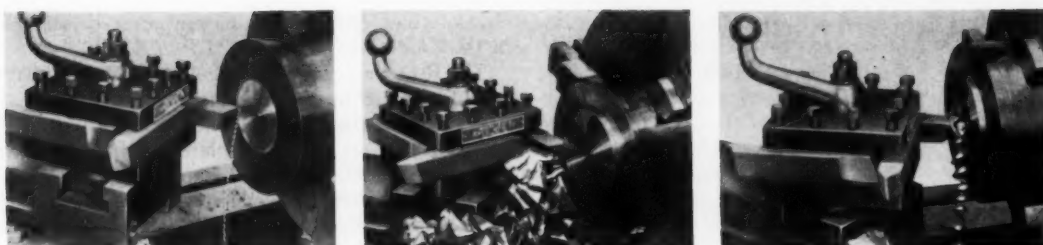


Fig. 2. Sheffield Precisionaire noncontact thickness gage for thin, fragile parts



(Left) Square 3/4-inch bit mounted in Model 4 1/2-S Enco turret used to face work. (Center) Same tool shown indexed to next position for taking a 1-inch deep broad-faced cut. (Right) Tool shown being used for inside chamfer

gage-point pressure by literally floating the part in air during gaging. The pressure-free gaging operation is obtained by means of opposed air jets: one is in the gage head and the other in the anvil.

The air flowing out of the jets calipers the part to give accurate, repeatable thickness indication by the position of the float in the Precisionaire column. The instrument can be used also to measure the thickness of plastic film, sheet rubber, thin glass, etc.

A third new item (not illustrated) is a pneumatic isolation table designed to prevent ground and shop vibrations from being transmitted to delicate precision instruments.

In addition, Sheffield will demonstrate many types of Precisionaire and Accutron electronic dimensional inspection instruments and gages, including the Uni-point Holechek for measuring holes down to 0.017 inch in diameter. The Teletemp temperature-measuring instrument that detects and indicates the temperature of the work-piece, gage, setting master, and ambient air to 1/40 degree will be in operation.

Circle 585 on Readers' Service Card

Sentry Electric Furnace for Heat-Treatment of Steels

Booth 1724

The Sentry Co., Foxboro, Mass., will operate a Model "Y" electric furnace of their latest design, demonstrating scale-free, decarburization-free hardening on molybdenum high-speed steel. The equipment used will be similar to that illustrated.

Positive, protective atmosphere for high-carbon, high-chromium, and high-speed steels is created within the furnace work chamber by Sentry "Diamond Blocks." This simple, effective atmosphere-control system requires no adjustment or special operator skills. Tools can be "soaked" in the Sentry block atmosphere to assure full hardness without danger of surface deterioration. Visitors to the show are invited to bring samples of their high-speed-steel tools for on-the-spot demonstration hardening.

Circle 586 on Readers' Service Card

Sentry Model Y electric heat-treatment furnace

Turret Toolposts Featured in Enco Exhibit

Booth 3834

A complete line of turret toolposts, tailstock turrets, and self-indexing "Hexturrets" will be featured in the exhibit of the Enco Mfg. Co., Chicago, Ill. Recently introduced "Micro-Set" adjustable centers for lathes and grinders and the "Tiny-Titan" magnetic-base tools—indicator holders, magnifier holders, lights, etc.—will also be displayed by this company.

Enco turret toolposts have guaranteed reindexing accuracy to 0.0005 inch at each of the twelve indexing stations, which are spaced 30 degrees apart. Twelve-station indexing permits one tool to do the work of three, since each tool may be indexed to three positions, as shown in the accompanying illustrations. Patented "O" ring seals incorporated in all Enco turret toolposts keep dust and chips from getting up into the indexing mechanism. The turret tool-



NEW MACHINERY AT THE SHOW

posts may be used on virtually any bench, engine, or turret lathe, and on screw machines.

The Micro-Set adjustable center permits quick, easy center alignment on lathes or grinders. Adjustments are calibrated in increments of 0.001 inch on the diameter of work. Any operator can align centers in a fraction of the time usually required.

Tiny-Titan magnetic-base tools have an exceptionally strong magnetic pull to ensure vibration-free anchoring of indicators, magnifiers, and lights. These bases mount on flat surfaces and round surfaces down to 3/4 inch round. Fast-action cam type release on duplex models permits quick setup and release.

Circle 587 on Readers' Service Card

Grinding Fixture for Bent- and Hook-Shank Taps

A special tap-grinding fixture designed for fast, accurate sharpening of bent- and hook-shank taps will be introduced by the R-O Mfg. Co., Madison Heights, Mich. This new fixture completely eliminates the necessity of removing nib type taps from the shank for flute grinding or relieving of chamfers. Taps are inserted through the collet from the rear, requiring no more than ordinary collet practice in chucking. In addition to time and labor savings in setup, the fixture eliminates resoldering of tap to

shank, which often results in tempering or annealing of the tool.

The R-O bent- and hook-shank tap grinding fixture is hand rotated and can be mounted on any conventional cutter-grinder table. The standard unit is furnished with cam and index-plate for three-flute taps. Collets are available for all sizes of taps.

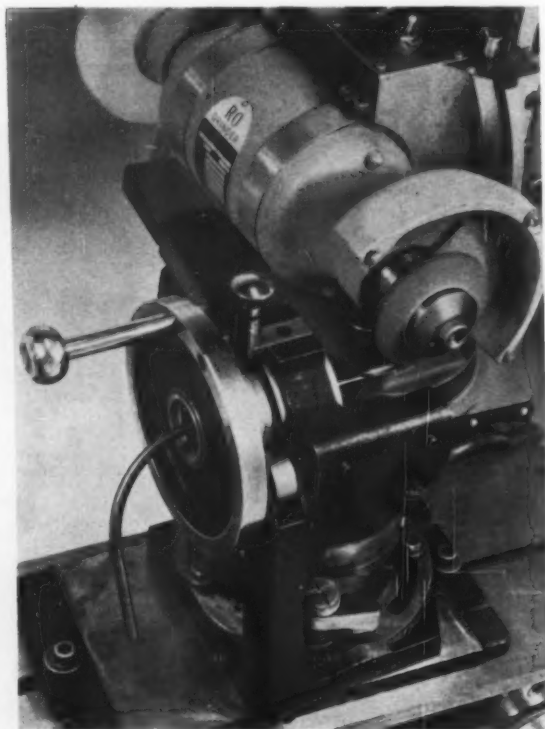
The fixture has a specialized function and is not intended to replace the R-O universal form-relieving fixture, which is used to relieve regular taps and to perform all radial relief, axial relief, and combinations of radial and axial relief in sharpening cutting tools and other work. The illustration shows the grinding wheel in position and index-plate plunger engaged for flute grinding on the special bent- and hook-shank tap grinding fixture. The fixture can also be set up for form-relieving the chamfers on the bent- and hook-shank taps.

Circle 588 on Readers' Service Card

Cooper Weymouth Automatic Roll Feed and Powered Stock Reel

Booth 1239

Roll feeds which automatically deliver coil stock to stamping presses at speeds up to 450 press strokes per minute will be exhibited by Cooper Weymouth, Inc., Stratford, Conn. These feeds are operated by



R-O fixture for grinding bent- and hook-shank taps

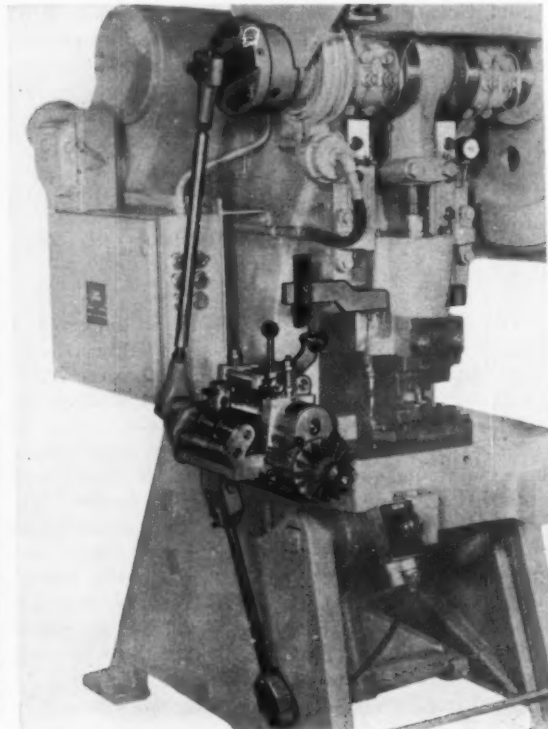


Fig. 1. Cooper Weymouth 6-inch roll feed mounted on press

an eccentric hub from the press crankshaft as shown in Fig. 1. One simple adjustment is all that is necessary to change the feed lengths.

The new feeds are of rugged construction and have roller or ball bearings for all rotating parts. The top roll has a release and lockout device, and is automatically reset by downward movement of the press ram. A unique feature is the high-speed disc type brake, which has double the usual braking area, is air-cooled, and uses disc linings which are easily replaced. The feeds are available in two types—either direct or compound geared (the latter being designed for feeding extra-long lengths).



Fig. 2. Cooper Weymouth heavy-duty powered stock reel

These roll feeds are made in fifteen sizes, with maximum feed lengths ranging from 2 to 12 inches and a variety of stock widths from 2 to 12 inches. The Model No. RF 6060 roll feed in the 6-inch stock-width size is shown in Fig. 1.

A heavy-duty stock reel (Fig. 2) for coil stock, up to 2500-pound capacity, will also be displayed. These larger-capacity reels supply the stock to presses and accessory feeding equipment in a smooth, even flow. Units are power-driven and can be synchronized to other equipment by means of a loop-arm-actuated mercury switch. They are equipped with electric disc type brakes that are long-lasting and smooth-acting. Coils are automatically centered and balanced for easy unwinding. Keepers can be adjusted for fast stock loading.

Rugged construction is employed throughout these stock reels, with heavy-duty ball bearings used on all rotating parts to assure durability and smooth action. The reel is available in 12-, 18-, and 24-inch stock-width sizes with maximum outside diameter of 40 inches, inside diameter of 20 inches, and minimum inside diameter of 15 inches. It is powered with a 1 1/2-hp, three-phase motor.

Circle 589 on Readers' Service Card



Fig. 1. DoALL Model 1613-3 Contour-matic designed to use new tungsten-carbide band-saw blades

DoALL to Display and Demonstrate New Metal-Cutting Band Saws and Blades

Booth 2222

Demonstrations and displays designed to eliminate the mystery and confusion regarding the multiplicity of blades available to band-saw users will feature the exhibit of the DoALL Co., Des Plaines, Ill. Factory-trained DoALL technicians will duplicate shop and production line setups to show visitors that the right combination of blade and machine is a prerequisite for best results and increased productivity.

A backwall display, "College of Saw Knowledge," will complement the actual sawing demonstrations. It will present clarifying, informative data about five major types of DoALL blades. The differences between them and the reasons why the right blade and machine must be brought together as a team to cut any material with maximum efficiency will be emphasized.

Also exhibited for the first time will be the company's new line of hydraulic units for original-equipment manufacturers. These products include variable-delivery hydraulic pumps and solenoid- and



Fig. 2. Close-up of tooth of Super Demon band-saw blade introduced by the DoALL Co.

NEW MACHINERY AT THE SHOW

pilot-operated hydraulic valves. A DH-612 hand grinder will show how 0.0001-inch accuracy can be maintained in finishing operations by direct hand-wheel settings. Displays and demonstrations of the latest DoALL gaging equipment and cutting tools will complete the exhibit.

A Model 1613-3 Contour-matic band machine, Fig. 1, will be teamed with the new "Super Demon" blade, Fig. 2, to illustrate how vertical band machine users can raise productivity and increase profits on production runs. The Super Demon is made by the exclusive "Tufftriding" process, a nitriding treatment that toughens and hardens high-speed-steel blades uniformly. The process also increases wear resistance at the red heat generated by fast cutting velocities, thus providing longer wear life when sawing tough, abrasive, or dense alloys.

The spectacular sawing performance of the new tungsten-carbide blade will also be demonstrated on DoALL's two new cutoff machines, the "Continental" production saw and the C-70 TC. They are built with the power, rigidity, high-pressure coolant system, and controlled speed and feed required to utilize the cutting ability of tungsten carbide.

Circle 590 on Readers' Service Card



Fig. 1. (Above) Penguin/5 mechanical refrigeration chamber to be displayed by Cincinnati Sub-Zero Products

Fig. 2. (Right) Bench type Ultratemp/800 environmental thermal shock chamber

Cincinnati Sub-Zero Products to Display New Production Chilling Units

Booth 2002

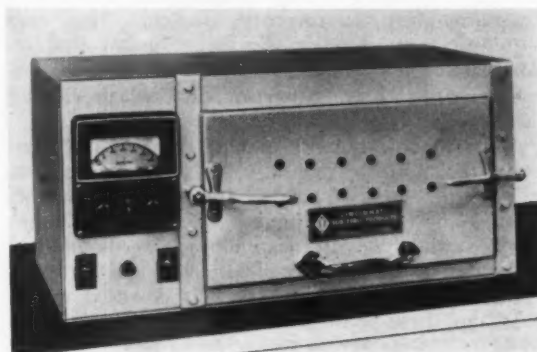
The newest in mechanically refrigerated chambers, the Penguin/5 (Fig. 1), especially adaptable for miniature applications in the field of metallurgy and assembly, and the Ultratemp/800 environmental chamber, Fig. 2, will be displayed for the first time by Cincinnati Sub-Zero Products, Cincinnati, Ohio. The 1/2-cubic-foot chamber of the Ultratemp, Fig. 2, affords a pulldown to minus 100 degrees F. in five minutes, and a warm-up to plus 500 degrees F. in thirty minutes.

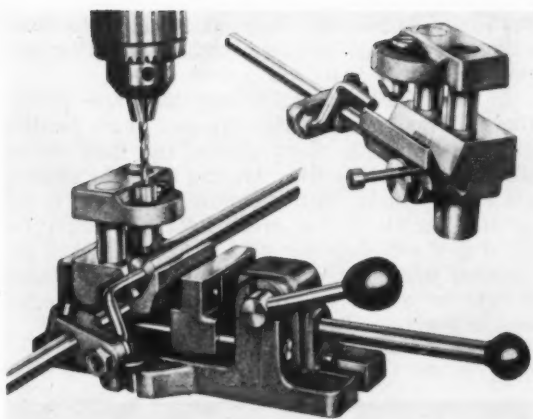
The 1/2-cubic-foot environmental chamber, see Fig. 1, is ideal for research and development testing, moderate job-shop applications, expansion fit assembly work, as well as medical research and pharmaceutical and/or biological storage. Whether employed for transistor testing, miniature-bearing manufacture, or numerous other uses, the Penguin/5 is especially adapted for use where space is at a premium. This versatile chilling machine occupies less than 2 1/2 square feet of floor space, and it is caster-mounted to facilitate portability.

Standard low-temperature range is from minus 10 to minus 60 degrees F.; it is also available with a high range to 500 degrees F. The chamber is 15 inches long, 9 inches wide, and 8 inches deep and is surrounded by 2 1/2 inches of low "K" factor insulation.

The Ultratemp/600 and Ultratemp/800 (Fig. 2) are especially designed for bench-top operation and are ideal for all research and development applications. Completely removable, file-drawer type door gives access to the steel chamber, which measures 16 inches long, 8 inches wide, and 8 inches high. Model 600 is designed and instrumented for operation between minus 100 and plus 500 degrees F. with a 5-minute pulldown and 30-minute warm-up. Ultratemp/800 has a low temperature of minus 320 degrees F. and a high of plus 500 degrees F. Each is instrumented to an accuracy of plus or minus 1/2 degree F. Both models are engineered for maximum economy of refrigerant, and are protected by 3 inches of low "K" factor insulation.

Circle 591 on Readers' Service Card





Heinrich Grip-Master vise with drill-jig attachment

Heinrich Drill-Jig Attachment

Booth 1227

A production drill-jig attachment to be exhibited for the first time by Heinrich Tools, Inc., Racine, Wis., is designed to convert this manufacturer's "Grip-Master" vise into a fast-action adjustable drill jig for precision cross-hole drilling of 1/8- to 2-inch round or hexagonal stock. In addition to the jig attachment, the exhibit will include the full line of Grip-Master vises, as well as several other products.

The "Vise-Jig" is simply attached to the stationary vise jaw in place of the removable jaw insert as shown in the illustration. The "Circle-Grip" locking mechanism—used successfully in Grip-Master vises for fifteen years—assures instant, positive clamping; and the vise provides a safe, handy base which can be clamped to the machine table.

The clamping plate is quickly adjusted to suit the size of the work-piece. Just a light pressure on the locking lever serves to exert sufficient force against the locking plunger of the jig. This, in turn, pulls the clamping plate down against the work-piece. Simply flicking the lever to a vertical position unclamps the work, permitting it to be removed. The Vise-Jig can be locked and unlocked with one hand, leaving the other hand free to load and unload the work.

An adjustable stop, with 9-inch long rod, for locating work longitudinally is furnished for use on either side of the jig. The Vise-Jig can also be attached to Heinrich air vises equipped for foot control.

Two sizes of the Vise-Jig are offered. The Model 3-UJ fits in all Heinrich vises, holds from 1/8- to 3/4-inch round or hexagonal stock, and is furnished with a 5/16-inch inside-diameter adapter liner to hold bushings for a range of 0.0312- to 0.1935-inch holes. The Model 6-UJ fits in 6- and 8-inch Heinrich vises, holds from 3/4- to 2-inch stock, and is furnished with 5/16-, 1/2-, and 3/4-inch inside-diameter adapter liners, to hold bushings for holes ranging from 0.0312 to 0.5312 inches in diameter.

Circle 592 on Readers' Service Card

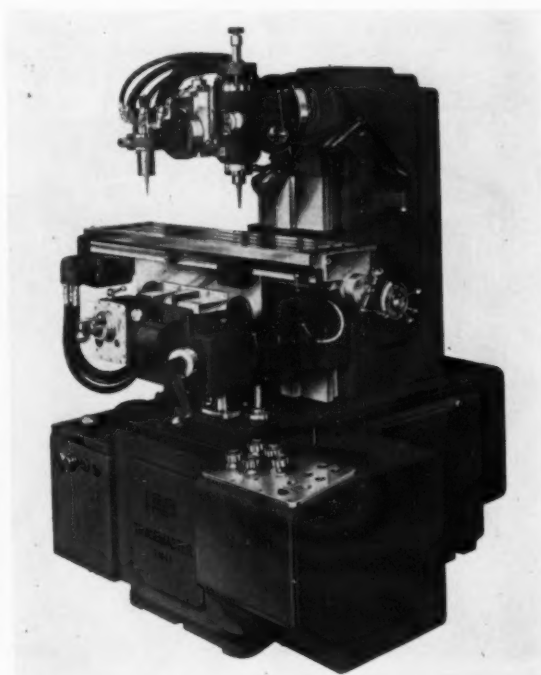
Lapointe to Exhibit Seven Precision Machine Tools in Operation

Booth 1105

The Lapointe Machine Co., Hudson, Mass., will have seven of their British-built precision machine tools on exhibition. All machines will be in full operation, producing parts to the close tolerances for which the various types have been built. They include: the Lapointe-Churchill Model BW 10- by 36-inch cylindrical grinder; Lapointe-Lang Model 10 B2 sliding, facing, and thread-cutting lathe with 24-inch swing, 60 inches between centers; Lapointe-Parkinson Model 5B Sunderland gear planer; Lapointe-Ward Model 3DS ram type turret lathe, of 2-inch bar capacity with air-operated bar feed and chuck; Lapointe-Hayes Model TM43A "Tracemaster" fully automatic copy die-sinking machine (shown in the accompanying illustration); Lapointe-Kitchen Walker radial drill, 14-inch column, 4-foot 6-inch arm; and Lapointe-Kearns Model No. 2 horizontal boring machine with built-in facing chuck.

In addition to these seven machines a true scale model of the Berthiez single upright vertical boring and turning mill will also be on display. Some Berthiez machines are built with a displaceable table that allows a part twice the diameter of the table to be machined. This provides maximum flexibility for the handling of a wide range of types and diameters of work.

Circle 593 on Readers' Service Card



Lapointe-Hayes Tracemaster die-sinking machine

NEW MACHINERY AT THE SHOW

Electronic Vertical, Single-Plane Balancing Machine

Booth 3917

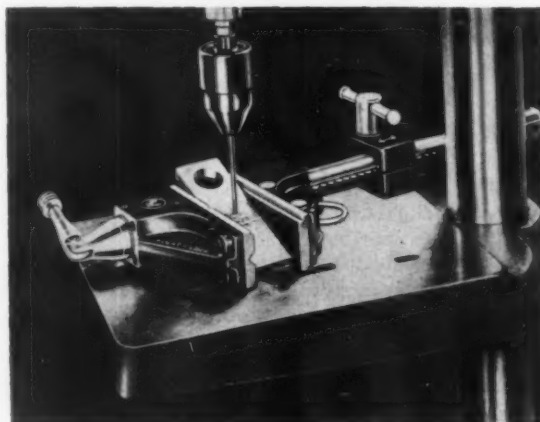
Quick and efficient balancing of rotors, flywheels, or any other rotative parts up to 200 pounds in weight and up to 30 inches in diameter is made possible by an electronic vertical, single-plane balancer to be introduced by the Industrial Balancer Department of Stewart-Warner Corporation, Chicago, Ill. There is an inverse relationship between weight and diametral capacity of this machine. For example, when the weight of the work is 50 pounds or less, the maximum diametral capacity is 30 inches; when the weight is 200 pounds, the maximum diametral capacity is 13 inches.

The new balancing device employs the strobe light and other operating principles utilized in Stewart-Warner cradle type and portable industrial balancers which will also be exhibited. However, the new balancer is both simpler and faster to operate than cradle type devices, and for the first time makes production balancing economically feasible for certain types of work. The vertical balancer has four potentiometers which permit four separate calibrations of the meter. Thus, the calibration for a production run of one size of pulley, for example, could be saved, or stored, and another pulley balanced on the same machine without upsetting the first cali-

bration. Conceivably, in production work, three calibrations would be saved, with the fourth switch position kept clear for job type work.

In using the balancer, the operator simply presses the start button, notes the reference mark location and the amplitude of unbalance, and then presses the stop button. Electrical braking stops the rotating piece very quickly. After returning the piece to the position shown by the strobe light, the heavy (or light) spot will show up at 12 o'clock. A switch determines whether the 12 o'clock position indicates a light or a heavy spot, depending on whether weight is to be removed or added.

Circle 594 on Readers' Service Card



Work-holding equipment to be demonstrated by AMF Tool Division, American Machine & Foundry Co.



Electronic balancing machine to be introduced by the Stewart-Warner Corporation

Automatic Chucks and "Float-Lock" Vises

Booth 3515

Fully automatic AMF Wahlstrom chucks, which permit tool-changing in just two or three seconds, and AMF "Float-Lock" drill-press vises, designed to turn a drill press into a complete machine tool, will be exhibited by the AMF Tool Division of American Machine & Foundry Co., New York City. With the AMF Wahlstrom chuck, there is no waiting for the spindle to stop. Four hardened and ground jaws automatically center the tool and provide a grip that cannot slip or chew up shanks. The greater the load, the tighter the grip.

The AMF Float-Lock instant-change vise assures positive anchoring on the drill-press table. It floats and locks in any position and holds the work safely for accurate drilling and tapping. It is excellent for angle drilling, serving as a low-cost jig, for holding small fixtures; and for many other applications.

Also on display will be AMF Lowerator controlled-heat work positioners. These mobile self-leveling units are designed to provide substantial economies and space savings in the handling and production of such delicate products as transistors.

Circle 595 on Readers' Service Card

Commander to Show Complete Line of Drilling and Tapping Equipment

Booth 3209

The Commander Mfg. Co., Chicago, Ill., will exhibit a complete line of multiple drilling, tapping, and related production tools. Seven models of the Commander "Multi-Drill," three "Multi-Tapper" models, plus the single-spindle "Midget" and standard tappers and the "Lead-Matic" lead-screw tapper will be shown and demonstrated. In addition, a number of the new Model "A" multiple-angle drill units will be arranged in a multiple drilling setup to illustrate the use of the unit in difficult off-line drilling operations.

The high-speed air-actuated "Pneu-Matic" tapper, which is adaptable for automatic or semiautomatic tapping cycles, will also be in operation. Along with these products, Commander will exhibit an extensive line of accessories for its production tools.

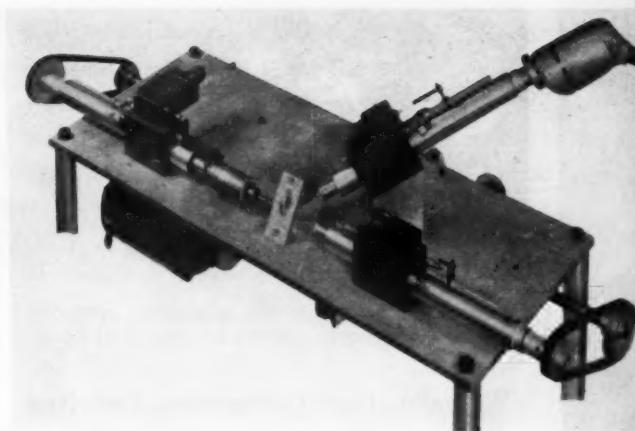
Circle 596 on Readers' Service Card

Drill Pointer with Hopper Feed

Booth 1240

The Winslow Product Engineering Corporation, Arcadia, Calif., will exhibit a new drill pointer with an automatic hopper feed. Known as the Model 100-C, this new addition to the Winslo-Matic drill-point grinder line will accommodate drills ranging in size from No. 80 to 1/2 inch in diameter. The unit is said to be extremely fast, having a maximum production rate of 1500 drills per hour.

The hopper feed attachment is completely automatic. Up to 500 drills can be placed in the hopper bin which is mounted above the work-head. Additional drills may be added to the hopper as required to keep production at a continuous high rate. After



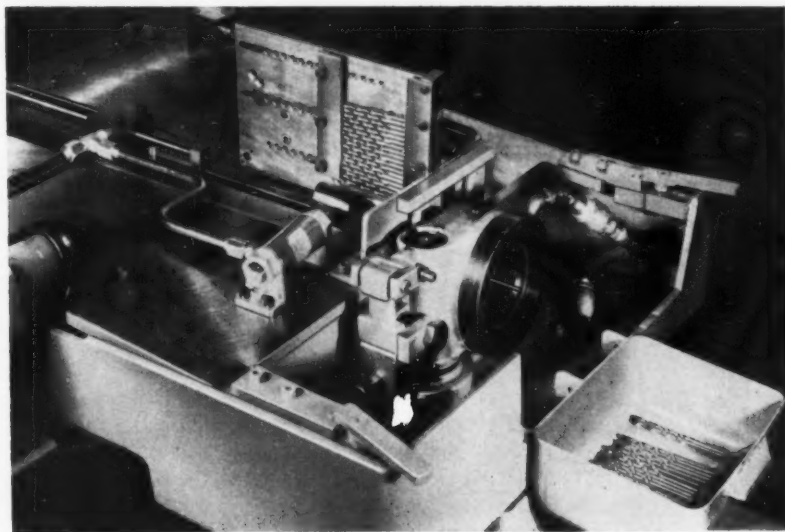
Commander units set up for multiple-angle drilling

the grinding operation, drills are neatly deposited in a tray in front of the work-head.

The machine is completely automatic in all respects, even to the wheel-dressing and compensating operations. Because of the ultraprecision point, concentric within 0.0002 inch, drills sharpened on this pointer produce extremely close-tolerance holes, eliminating most reaming operations and greatly increasing tool life.

The latest accessory for the Model 100-A Winslo-Matic drill pointer, not shown, is a new work-head for grinding chamfers on taps. An exceptionally fast grinding rate of twelve taps per minute is claimed by the manufacturer for this equipment. The angle of chamfer grind is determined by the angle formed on the grinding wheel, and the same ultraprecision is attained as on the drills ground on the drill pointer. This high degree of precision enables the user to produce tapped holes to Class 5 precision.

Circle 597 on Readers' Service Card



Winslo-Matic drill-point grinder with automatic hopper feed

NEW MACHINERY AT THE SHOW



Waspalloy lock-nuts for high-temperature applications developed by the Standard Pressed Steel Co.

Waspalloy High-Temperature Lock-Nuts

An elevated-temperature lock-nut made of Waspalloy, a nickel-base alloy, intended for use with high-performance bolting at temperatures up to 1400 degrees F. is announced by the Standard Pressed Steel Co., Jenkintown, Pa. Designated FN 1418, this one-piece self-locking nut has properties which make it possible to utilize the full potential of high-strength 1200- and 1400-degree F. bolts. The principal applications of the new lock-nut are on jet and rocket engines, missiles, gas turbines, and other high-temperature power generation equipment.

The FN 1418 lock-nut is rated at a room-temperature tensile strength of 180,000 psi minimum. Minimum tensile rating at 1200 degrees is 130,000 psi, and at 1400 degrees, 100,000 psi. This lock-nut is of the twelve-point external-wrenching type, silver-plated, and available in sizes from 10-32 through 1/2-20. The nuts have a torque locking arrangement for reduced-diameter bolt threads.

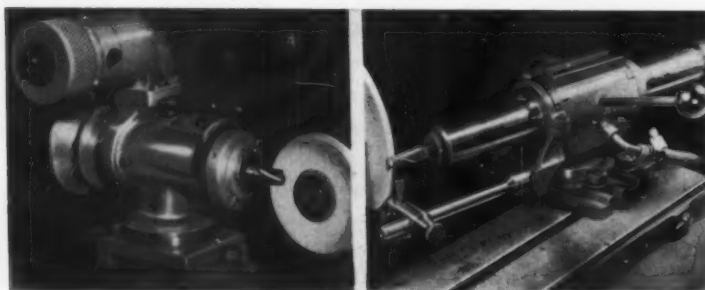
Circle 598 on Readers' Service Card



Fig. 1. (Left) Harig 612 surface grinder

Fig. 2. (Below, left) Harig relief and drill-point grinder

Fig. 3. (Below, right) Air-Flo fixture



Machine for Presetting Cutting Tools Used on Tape-Controlled Machine Tools

Booth 1314

A unique machine, which enables precision cutting tools to be preset to rigidly accurate standards demanded by continuously operating, numerically controlled machine tools, will be unveiled by the Microbore Division of DeVlieg Machine Co., Royal Oak, Mich. The machine represents another step toward the elimination of machine tool down time for changing cutting tools. It narrows, further, the time gap in preparing the accurate tooling required for such continuously operating machines and drastically reduces errors due to the human element. The equipment will be demonstrated along with bench type cutting-tool presetting systems in a special precision tool "presetting clinic," to be conducted daily.

The precision-tool presetting machine will be demonstrated during the course of the clinic in the presetting of boring-bars, milling cutters, drills, and other accessory tooling to precise tolerances for both diameter and depth. For viewing the cutting-tool point, the machine makes use of precision measuring and optical systems, which can be read directly to 0.0001 inch, without interpolation.

The clinic also will cover methods of using two existing bench type techniques. One method employs adjustable-pin blocks to preset Microbore lock type units for single- or multiple-tool boring-bars. The other uses a double-end spindle for presetting boring-bars to finish-hole sizes.

Circle 599 on Readers' Service Card

Harig to Display New Machine Tools

Booth 1514

The Harig Mfg. Corporation, Chicago, Ill., will have on display three of its newest machine tools. Other items, including carbide and steel dies, vises, and the Harig "Grind-All" fixture for precision grinding of perforators, will also be exhibited.

The Harig 612 surface grinder shown in Fig. 1 is one of the three newest machines on display. The other two machines in this group are illustrated in Figs. 2 and 3.

Circle 600 on Readers' Service Card



Fig. 1. Electroperm chuck developed by the O. S. Walker Co., Inc., for holding large work

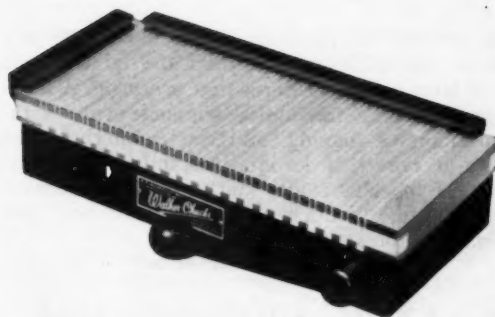


Fig. 2. Top plate with fine gap divisions designed for Walker Ceramax chucks

O. S. Walker Demagnetizer and Chucks

Booth 2418

A low-frequency demagnetizer developed to solve the problem of obtaining full penetration of the demagnetizing field in large magnetized work-pieces will be demonstrated by the O. S. Walker Co., Inc., Worcester, Mass. This new demagnetizer, originally conceived as a possible solution for the demagnetization of heavy diesel-engine heads, works on the principle of subjecting the work-piece to a very strong magnetic field alternating in polarity at a much lower frequency than the usual 60-cycles per second. This lower pulse rate, combined with the powerful field, permits full penetration of the demagnetization of larger and heavier work-pieces than heretofore obtainable. The balanced alternating magnetic field may be smoothly decayed automatically until the work-piece is completely demagnetized or, to accomplish the same result, the work-piece may be gradually removed from the field of the demagnetizer.

The Electroperm chuck, Fig. 1, another new O. S. Walker Co. development that eliminates the problems caused by heat generation when holding large ferrous work-pieces, will also be demonstrated. Distortion due to thermal expansion is eliminated while dimensional stability of the chuck is maintained. The chuck combines permanent magnets with electric coils.

Electric current turns the chuck on, but once it is electrically energized, permanent magnets take over to provide the magnetic holding power during machining operations. Besides eliminating the problem of thermal expansion, the permanent magnetic holding feature also eliminates the danger of power failures. These chucks are available in a complete range of sizes from 12 by 24 inches to 42 by 96 inches.

A new top plate, Fig. 2, for Walker Ceramax chucks that features intermediary magnetic poles to make the gap divisions finer than previously obtainable will be another exhibit of the O. S. Walker Co., Inc. The nonmagnetic gaps have been reduced from 1/4-inch stainless steel to 1/16-inch stainless steel.

The 1/4-inch poles have been retained and intermediary 1/8-inch magnetic poles have been added. The holding power for larger work-pieces has been maintained through the retention of the 1/4-inch poles, while the addition of the 1/8-inch poles permits the chuck to hold securely thin work and pieces as small as 1/8 inch in diameter. The new top plate is available on Walker Ceramax chucks in sizes from 4 by 4 inches through 6 by 18 inches.

Circle 601 on Readers' Service Card

Universal Hand Tapping Machine

Booth 2450

A Model VT-1 universal hand tapping machine designed for faster accurate tapping operations will be one of the new products to be displayed by the Toolroom Equipment Division of Producto Machine Co., Bridgeport, Conn. This machine is specially



Producto universal hand tapping machine designed for fast operation

NEW MACHINERY AT THE SHOW

designed for adaptability and complete freedom of action.

An operator can instantly swing the tap to any point on the table—even beyond the table in the case of large parts or fixtures that overhang. A floating arm guides the tap into the true hole center without pushing or tugging, and the counterbalanced column is raised or lowered instantly and effortlessly. The machine is also said to require minimum tapping torque, reduce three-lead distortion and eliminate tap breakage.

Circle 602 on Readers' Service Card

Pratt & Whitney SIM Production Lathe

Booth 2529

A powerful 7 1/2-hp production lathe built for fast metal removal and which is accurate to toolroom tolerances will be shown in operation by the Pratt & Whitney Co., Inc., West Hartford, Conn. This machine, known as the P&W SIM T-5 10-inch production lathe is capable of producing exceptionally fine finishes. Although it can take heavier cuts than most lathes of this class, it can also take the most delicate cuts on frail work-pieces. Repeat diameters can be picked up quickly and easily, and small- and medium-job lot turning operations can be handled efficiently and economically.

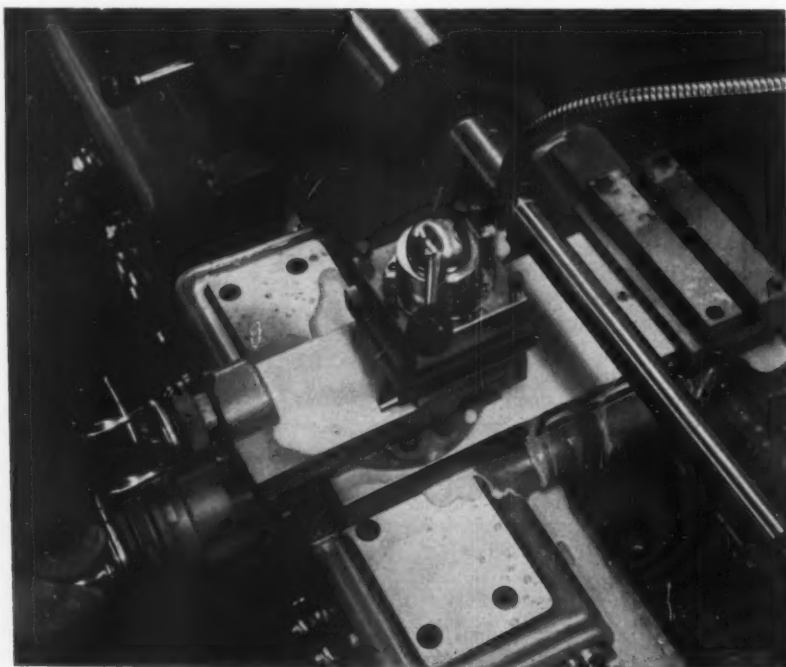
This lathe is said to have more standard equipment and built-in operating and safety factors than most lathes, and is built to the extremely rigid P&W specifications. The motor supplies sufficient power to

remove metal rapidly at speeds up to 2800 rpm. The vibrationless performance necessary to produce really heavy cuts, delicate cuts, and fine finishes is made possible by the cast-iron bed and base assembly which incorporates double wall-bed construction and forms a highly solid and rigid unit. The correct speed and feed for any kind of cut in any type material is allowed by nine forward and reverse speeds and nine longitudinal and cross-slide feeds.

The desired length of cut is automatically obtained by micrometer-adjusted carriage slide stops which trip the power feed to the carriage at any desired location. Repeat diameters are picked up by selecting a preset cross-slide stop. Production and efficiency are increased by the ability of the spindle to run clockwise or counterclockwise at all spindle speeds. Quick reversing with a full range of reverse speeds allows full utilization of the rear toolpost without chatter. Because of the reversing feature, the tendency to lift tools from the rear cross-slide is eliminated and there is no need for lost time in turning tools upside down.

Longer life of the machine is assured by such built-in features as a lubrication system which automatically lubricates all main units; hardened and ground chromium-nickel gears throughout; case-hardened and ground steel carriage ways of the inverted vee type; hardened spindle and tailstock quill to resist wear; and a power meter which registers the power being consumed at any instant, protects the equipment from overloading, and indicates any dulling of the cutting tool.

Circle 603 on Readers' Service Card



Precision production lathe to be exhibited by Pratt & Whitney Co., Inc.



B&S Sawperior slitting saw

"Sawperior" High-Speed Saws

The Brown & Sharpe Mfg. Co., Providence, R. I., is introducing a Type 600C slitting saw called the Sawperior. This saw has a mirrorlike finish which gives free cutting action without seizing even on stringy materials. It is made from a new high-speed steel and has improved teeth designed for fast, free cutting. In extensive shop tests these saws more than doubled the production attained with previously used types. The Type 600C slitting saw will be available from stock from local distributors in eighteen different sizes—2 1/2 to 6 inches in diameter.

The new tooth shape and finish of these saws are claimed to have increased tool life between sharpenings as much as four times. The smooth finish also serves to resist rust and corrosive action of coolants, and the hard glazed surfaces resist scratching and galling on the sides. Superfinish also permits the use of less concavity or dish, thereby providing a stronger saw section and a stiffer, more accurate saw capable of taking heavier cuts without strain or chatter. The Sawperior high-speed saws are recommended for general-purpose slitting, cutting off, or for sawing most materials.

Circle 604 on Readers' Service Card

Sintercast Machinable Carbides

Booth 3901

"Ferro-Tic," said to be the only steel-bonded carbide on the market, will be exhibited by the Sintercast Division, Chromalloy Corporation, West Nyack, N. Y. Tools and components highly resistant to temperature, corrosion, and wear may be fabricated from this material, using conventional machine tools.

The machinable blanks of cemented carbide are produced by powder-metallurgy techniques. Crystals of titanium carbide are embedded in a relatively soft matrix of stainless or tool steel, then sintered. The blank retains the desirable properties of both of its constituents: titanium carbide's ultrahardness and steel's machinability. Ferro-Tic C depends on a tool-

steel matrix to achieve a heat-treatable and wear-resistant product. When stainless steel is used, the resulting Ferro-Tic S is highly corrosion-resistant.

Circle 605 on Readers' Service Card

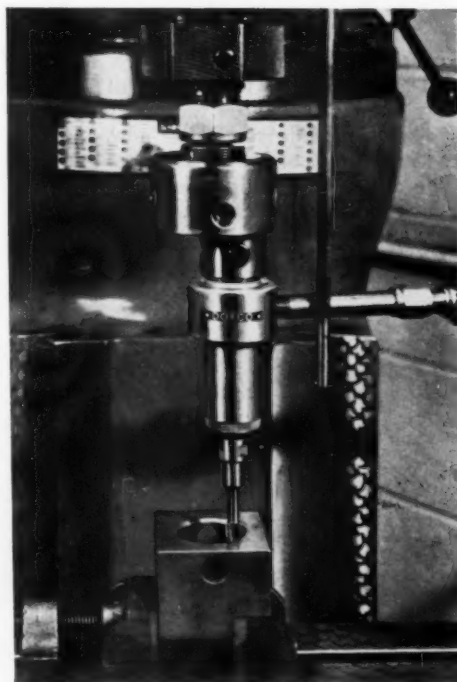
Dotco Hole Grinders

For grinding tough materials to close tolerances and smooth finish, a new, versatile pneumatic hole grinder with high power and speeds up to 30,000 rpm is being introduced by Doeden Tool Corporation, Hicksville, Ohio. Inserted in a boring head and used on a vertical or horizontal mill, boring machine, lathe, or jig borer, this Dotco hole grinder will jig-grind any size hole—before or after heat treatment—as well as grind the outside surfaces of cylindrical members. The setup is similar to that of other offset boring work, the Dotco hole grinder being simply substituted for the boring-bar.

Fine finish and superior accuracy are claimed for this grinder, which is equipped with a four-vane rotary air motor, precision ball bearings, and Erickson interchangeable collets. Extreme accuracy in operation with maximum runout of only 0.0005 inch is claimed on all collet type grinders.

Dotco hole grinders are available in two sizes with motor speeds of 25,000 and 30,000 rpm. Each size is also available with shank diameters of 1/2, 5/8, or 3/4 inch to fit different-size boring heads. The maximum hole size that can be ground is limited only by the size of the grinding wheel and amount of offset adjustment of the boring head in which it is used.

Circle 606 on Readers' Service Card



Doeden versatile pneumatic hole grinder

Dorsey Gaging Equipment to Be Displayed

Booth 3814

A dial bore gage with a special head designed for lighter weight, wider range, and greater ruggedness than preceding instruments of this type will be one of many new gages to be exhibited by the Dorsey Gage Co., Inc., Hyde Park, N. Y. This gage is said to provide the simplest and most accurate means for checking hole diameters. Even the least experienced person can easily use it to obtain accurate measurements.

The gage, Fig. 1, is of the internal comparator type with an indicator that eliminates guesswork and the sense of touch or feel. It will detect and show such conditions as bellmouth, barrel shape, taper, hour-glass, and out-of-roundness; and it gives the exact size of the hole on an indicator reading in graduations of 0.0001 inch. Each gage covers a wide range, and certain gages are designed to be interchangeable with one another in the same housing.

The gage can be used at the machine, the bench, or in the laboratory for individual pieces. It can also be used for regular inspection work or anywhere that internal measurements are required. The simple process of inserting the gage in the hole at an angle and rocking it to its highest point will obtain the correct reading on the dial. Centralizing plungers automatically position the gage so that the line of the gaging axis passes through the center of the bore, thus enabling one to get the correct reading at each pass. This will detect out-of-roundness, taper, bellmouth, etc. Eight models of this Dorsey bore gage cover a range of 3/32 to 12 inches.

The simple, easy-to-set scribe gage, Fig. 2, is another Dorsey exhibit. This instrument is said to be the only one of its type on the market. It has been developed to provide something new and different for use in the toolroom by machinists and toolmakers. The operating principle involves the use of an 0.001-inch indicator to set a scribing mechanism accurately and precisely in a matter of seconds.

The gage is so constructed as to enable the opera-



Fig. 1. Dorsey dial bore gage with specially designed head



Fig. 2. Easy-to-set scribe gage

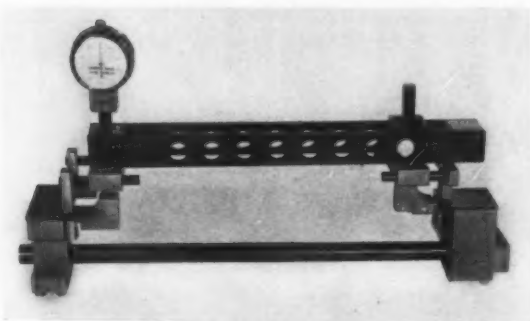


Fig. 3. Large-diameter Dorsey gage made in 6- to 60-inch sizes and to order for larger work

tor to have finger-tip control in adjusting the gage to the precise 0.001-inch reading anywhere within an inch range. This is done with the thumb screw on the side while reading the calibrations indicated to show the closest 0.100-inch setting and verifying this with the indicator, which will show the precise 0.001-inch setting on the dial. An efficient locking device secures this setting. The operator can then scribe from the surface plate onto the part quickly, accurately, and to precisely the measurement required. The gage is inexpensive and can be purchased with riser blocks of various sizes to cover measurements beyond the 1-inch range.

Other gages employing the same principle and which cover as much as a 12-inch range can be purchased. These larger gages are, of course, considerably higher in price.

Large-diameter, versatile, inexpensive gages such as shown in Fig. 3 will also be displayed. This type of gage can be set with a Dorsey "Set Master" for use as a combination master and gage for checking large diameters. These gages are equipped with the following types of contact points: standard pin, ball contact, shovel contact, and extended shovel con-

tact. All of these points can be supplied in steel or carbide.

The gage is designed to check wide flat surfaces, narrow or sharp flanged surfaces, grooves, recesses, tapers, gears, and splines, as well as diameters. The rest-pins are of a three-point system designed for large-diameter gages. The rest contacts can be modified for extra gaging height and unusual conditions or configurations. The rests can be of the following types: dowel, pin, and shovel. These rests can be modified to suit the specific gaging requirements of the customer.

Gages with ball contacts are commonly used for checking a specific depth and diameter of a part with an angular form, such as a taper. A specific formula is used and can be supplied upon request, or determined if a part print is supplied to the company. The gages are standard from 6- to 60-inch sizes, but gages for larger diameters can be furnished on request.

Other gages to be displayed and demonstrated include: a Dorsey dial-groove gage designed to check all types of internal grooves and recesses, including O-ring grooves, oil-grooves, thread-relief, and many other kinds of grooves; dial-pin gage and master made in three sizes or models for checking large diameters in a range of from 12 to 30 inches, with dial having 0.0005-inch graduations; and a versatile test gage for toolmakers, machinists, and inspectors. The latter gage can be used for fast, precision checking on surface-plate work, checking out-of-roundness of lathe work, and countless other checking operations involving machining and assembly work.

Circle 607 on Readers' Service Card

Clearing-Harrison Geared-Head Lathes

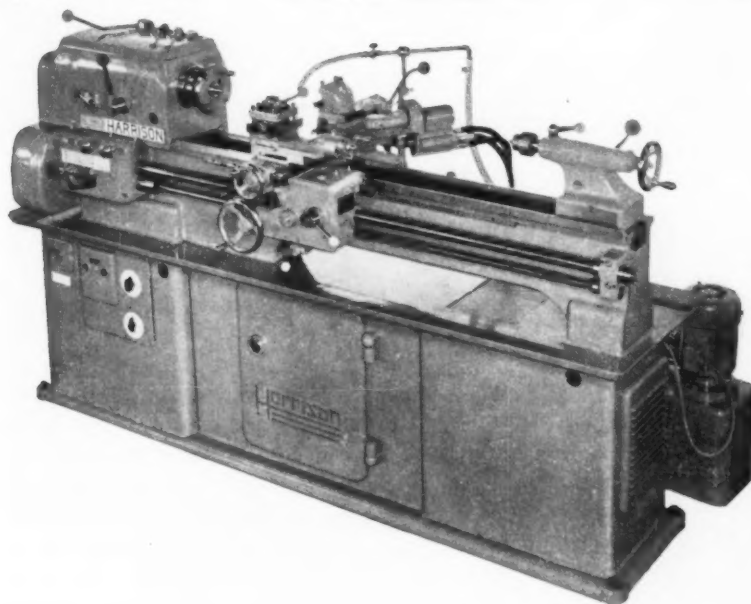
REM Sales, Inc., West Hartford, Conn., a subsidiary of the Robert E. Morris Co. (West Hartford) and national distributor for Clearing-Harrison precision geared-head lathes, succeeding the Clearing Division of U. S. Industries in this capacity, will have a new Harrison plain, horizontal milling machine, as well as the Clearing-Harrison lathes, exhibited under power at the show.

The Clearing-Harrison lathes are manufactured for the American metalworking market by T. S. Harrison & Sons, Ltd., Heckmondwike, England. These lathes, fitted with hydraulic copying equipment, are actually dual-purpose machine tools in that the tracer-turning facilities interfere in no way whatsoever with regular toolroom lathe functions of threading, turning, facing, and boring.

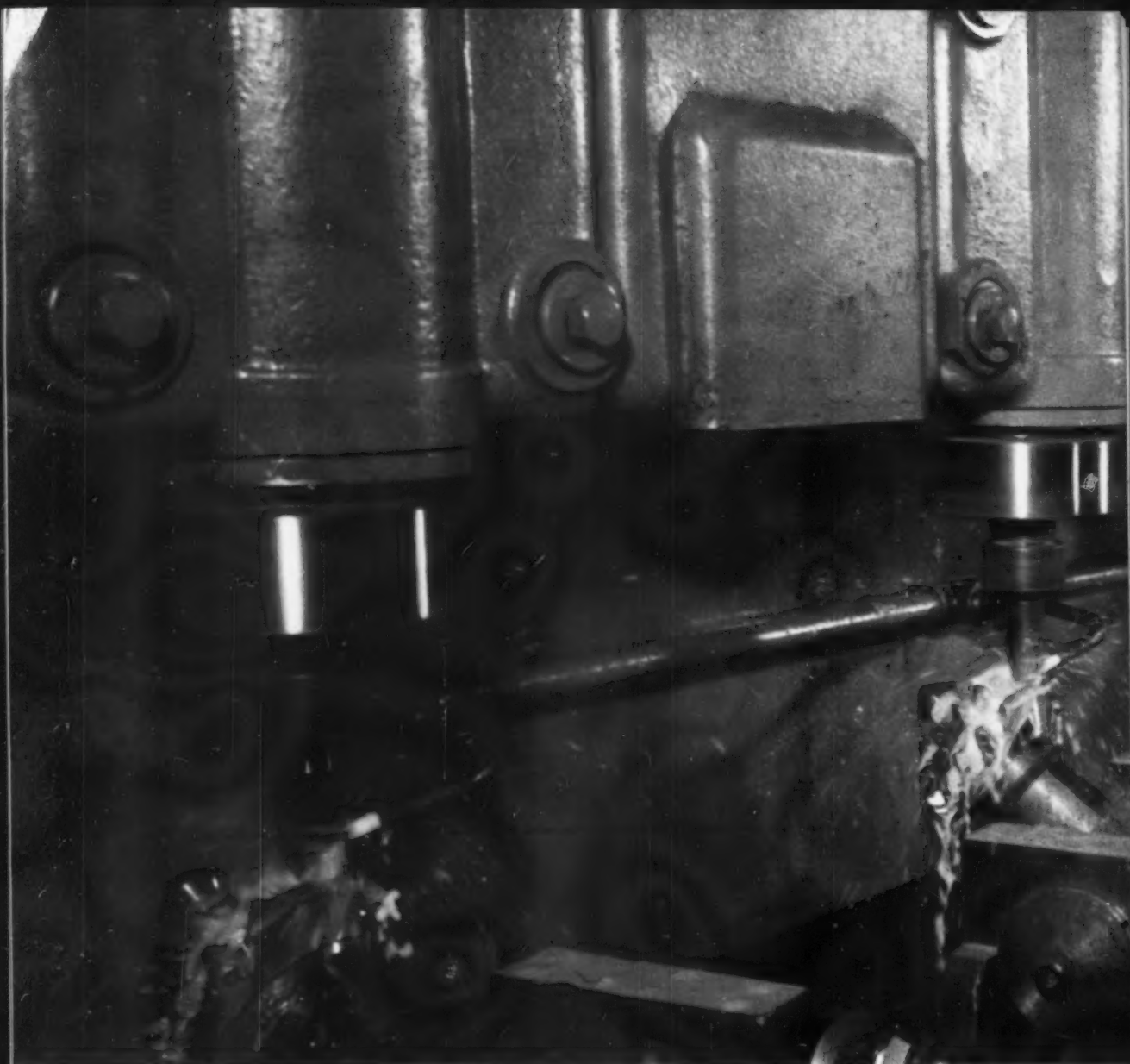
To meet the exacting demands of American toolrooms and production departments, all Harrison lathes feature antifriction spindles with American Standard Taper-Key noses, hardened headstock gearing honed by American Red Ring gear-finishing equipment, induction-hardened (not merely flame-treated) bedways, heavy-duty motor drives with clutch and brake provision, fail-safe electrical controls, wide speed selection, and integral heavy-gage cabinet bases.

The small 11- and 12-inch combination toolroom any copy lathes fill an important gap for the benefit of small-parts manufacturers who cannot afford the larger and more expensive copying lathes.

Circle 608 on Readers' Service Card



Harrison 12-inch toolroom and copying lathe to be exhibited by REM Sales, Inc.



Milling teeth in rock bits on a 4-spindle machine. The coolant: Gulfcut Heavy Duty Soluble Oil.

Change to Gulfcut® Heavy Duty Soluble peeling, cuts maintenance costs . . .

Varel Manufacturing Company has supplied rotary drilling tools to the oil industry for many years. Recently, this Dallas, Texas, firm had to battle a severe rust problem—in gearboxes and on finished parts.

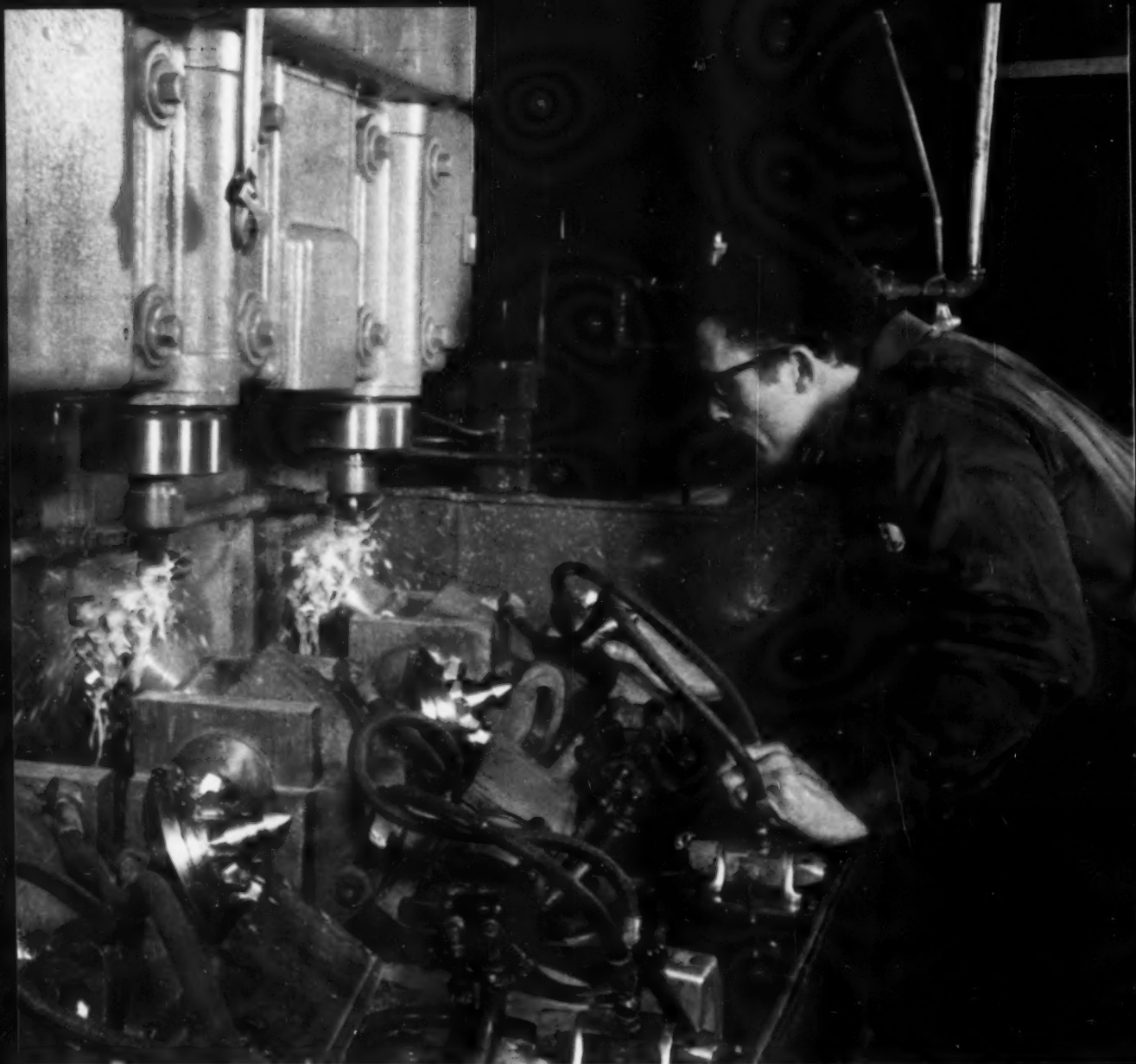
The company turned to Gulf for help. And got it. Gulf Engineers recommended Gulfcut Heavy Duty Soluble Oil in place of the chemical coolant then in use. Result: no more rust!

"By eliminating rust, scale and other junk," says Malcolm Thomas, Production Manager, "we brought

maintenance costs down to earth. Before the switch, our gearboxes got so rust-infested that we had to down machines for a whole day to clean them out. But that's no longer a problem—and neither is paint peeling.

"Here at Varel, we use a mixture of 30-40 parts water and one part oil. And we've found that Gulfcut Heavy Duty Soluble Oil meets every one of our machining requirements."

If you're faced with a stubborn machining problem, give us the opportunity to show you how Gulf makes



Oil eliminates rust and paint GULF MAKES THINGS RUN BETTER!

things run better! Call a Gulf Sales Engineer at your nearest Gulf Office. Or write for Gulfcut literature.

GULF OIL CORPORATION

Dept. DM, Gulf Building
Houston 2, Texas

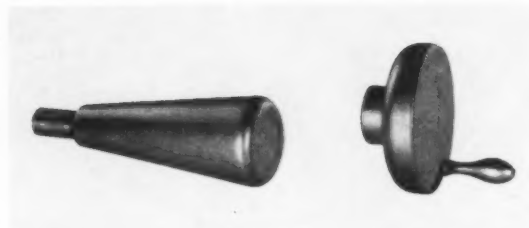


R. J. Blanton, left, Executive Vice-President & General Plant Manager of Varel Manufacturing Company, and Grover Garrison, Gulf Sales Engineer. In the foreground, a 12 $\frac{1}{4}$ " VHI rock bit. ▶



SP-10049

NEW MACHINERY AT THE SHOW



Steel hand knob and conical machine handle of line to be shown by Balcrank, Inc.

Machine Handles and Hand Knobs

Booth 3237

The Machine Tool Division of Balcrank, Inc., Cincinnati, Ohio, will have on display new conical-shaped steel machine handles and small-diameter, quick-turning steel hand knobs of the designs here illustrated. The conical-shaped handles, in both revolving and solid types, will be available in three sizes, with over-all lengths from 3 1/16 to 4 11/16 inches. All three sizes have been standardized with 7/16-inch diameter shanks for press fitting.

The small-diameter hand knobs, known as the Fastrol, are machined from solid bar steel. They are available in five sizes, ranging from 1 to 3 inches in diameter, complete with or without handle for easy turning. Both of these items are polished to a smooth, high luster and will also be available from stock chromium-plated.

Circle 609 on Readers' Service Card

Miniature Swivel-Pad Clamp

The Vlier Engineering Corporation, Los Angeles, Calif., is introducing a 10-32 by 1/2-inch size (Model SC-324) to its line of socket set swivel-pad clamps. These clamps are widely used throughout industry for holding parts in jigs and fixtures and in original equipment applications where parts must be securely held without damaging their surfaces.

Vlier miniature swivel-pad clamp



Like other sizes, the new clamp features a unique ball-joint pad construction which provides extremely smooth angle adjustment and rotation of pad. The pad swivels 7 1/2 degrees each side of the center line in all directions to accommodate off-angle surfaces. The body is made from alloy steel, heat-treated, and has a black-oxide finish.

Circle 610 on Readers' Service Card

Miniature Adjustable Cams and Fixture Components

Booth 3505

The Pic Design Corporation, East Rockaway, N. Y., a subsidiary of Benrus Watch Co., Inc., will show a complete line of stainless-steel tool components. Designed for use in all precision-machine jig, test fixture, and tool applications, this coordinated line of individual parts and complete assemblies includes clamps, dogs, studs, spacers, washers, jig buttons, legs, heel pins, springs, and precision-ground plates.

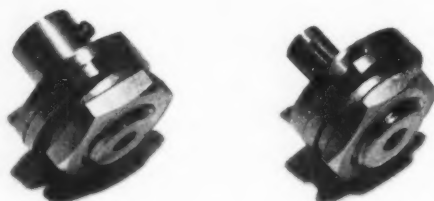


Fig. 1. Pic miniature adjustable stainless-steel cams

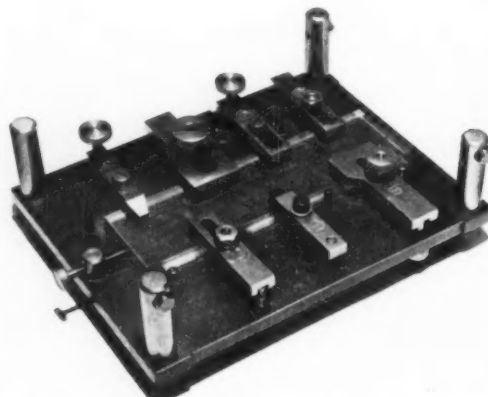


Fig. 2. Pic stainless-steel jig and fixture components

Precision cam followers with outside diameters ranging from 1/4 to 5/8 inch, designed for close-quarter timing applications, will be shown in face widths of 0.1406 to 0.1950 inch. These units are ball-bearing fitted on a concentric ground shaft to insure full-contact tracking and smooth, reliable operation. Fig. 1 shows two types of a series of miniature adjustable cam assemblies, and Fig. 2, some of the stainless-steel jig and fixture components to be displayed.

The cams, Fig. 1, are made in three shaft diameters of 0.1248, 0.1873, and 0.2498 inch. The radius of the cams to the top of the rise segments is 11/32 inch.

Circle 611 on Readers' Service Card
(This section continued on page 170)

HIGH-SPEED MACHINING OF NONFERROUS METAL PARTS

Since the airframe and related industries started using high-speed machining prior to World War II it has thoroughly proved itself as a means of securing low-cost production with good finish and close tolerance. There are many other industries now using high-speed machining methods with great success. They manufacture a variety of products, such as appliances, cameras, out-board motors, carburetors, pumps, valves, and carbon components, to mention just a few. Phenominal production records have been established and maintained wherever high-speed machining methods have supplanted older methods. The airframe industry has found it so beneficial that it is now the standard method throughout the industry.

Perhaps the answers to a few of the many questions asked about high-speed machining will explain the many advantages it offers.

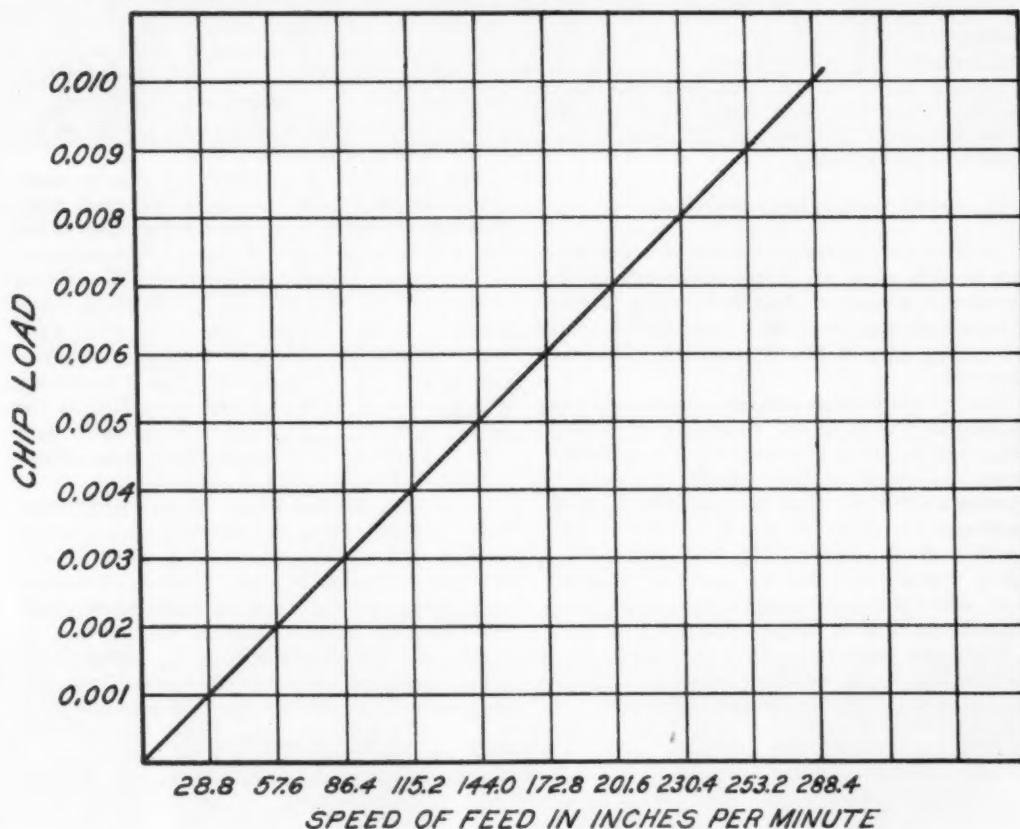
Q.—What is meant by high-speed machining of nonferrous metals?

A.—We define high-speed machining as a process in which cutter speeds from 5000 to 10,000

sfp_m are employed. To reach these cutter speeds, spindle speeds from 1800 to 100,000 rpm are required, depending upon the diameter of the cutter being used. High cutter speeds require proportionately higher feed speeds to maintain a given chip load on each tooth of the cutter. For example, a 6-inch diameter, eight-tooth cutter running at 3600 rpm (5400 sfp_m) will be cutting a chip 28,800 times per minute. To achieve a chip load of 0.001 inch per tooth, a feed speed of 28.8 ipm is required, as shown by the accompanying chart. A 0.002-inch chip load per tooth requires a feed speed of 57.6 ipm and so on up to possibly 0.010 inch per tooth, in which case, a feed speed of 288 ipm is required. The maximum thickness of chip depends upon the surface condition desired and the capabilities of the machine and its tooling, influenced by such factors as rigidity and horsepower.

Since the high frequency of cutting chips results in a high rate of metal removal, the foregoing example clearly illustrates the high productive capacity of the process. There are, of course, practical limitations to the cutter speed,

Chart showing chip load at different feed speeds of eight-tooth cutter operating at 3600 rpm.



MACHINERY'S DATA SHEET

because as speed increases, cutter balance and rigidity of machine and tooling become more critical.

Q.—What about tool life in high-speed machining?

A.—Tool life depends upon a number of variables, such as the material being cut (die castings, sand castings, extrusions, forged or rolled material, etc.), the geometry of the cutting edge, the rigidity of the machine and the work-holding fixture, the method of applying lubricant to the cutter, the thickness of the chip being removed per cutter tooth, the balance of the cutter, and the grade of carbide being used. This does not mean that all these conditions must be perfect before good tool life can be obtained, but each has an effect on tool life, some being more important than others.

A high-speed cutter can be designed to provide cutter life equal to, or better than, the cutter made for conventional feeds and speeds. Tool life should be measured by the number of pieces produced per cutter grind, not in the period of time that the cutter runs. This is important because the vast difference in production does not make time a proper basis for comparison.

Too often, cutter life is overemphasized. Since parts can be produced many times faster by using high-speed machining methods, more than enough money is saved in production time to enable a manufacturer to profitably spend a little more money for cutters and a little more time on their care and grinding.

Q.—Do chips weld onto the cutter?

A.—There is no reason to experience this problem in high-speed machining of aluminum. Our experience leads us to believe that this problem is the result of excessive heat developed between the cutting edge of the cutter and the chip being removed.

Heat is not a great problem when machining aluminum at high speeds because it is removed almost as fast as it is generated. To elaborate—when machining at high speeds, the cutter is turning much faster than at conventional speeds, sometimes as much as ten times faster. As a result, a much smaller chip load per tooth is taken, thereby reducing the heat that is generated, while still maintaining a feed speed many times faster than in former machining methods.

While the lighter chip load reduces the heat problem, the main reason for the absence of heat in high-speed machining is the short time of con-

tact between chip and cutter. The cut is taken so fast that the chip hardly gets a chance to transfer its heat into the cutting edge before it is thrown clear. When cutting at slow speeds, the chip remains in contact with the cutting edge of the tool for a much longer period of time. This contact period permits the chip to transfer its heat into the cutting tool. It is like picking up a hot potato. If you juggle it from hand to hand, you do not give it a chance to transfer its heat to your skin. However, if you hold it in only one hand, it will be mighty uncomfortable. The main reason for the extensive use of chipbreakers is to get rid of the hot chip.

Q.—How about the use of coolant in high-speed machining?

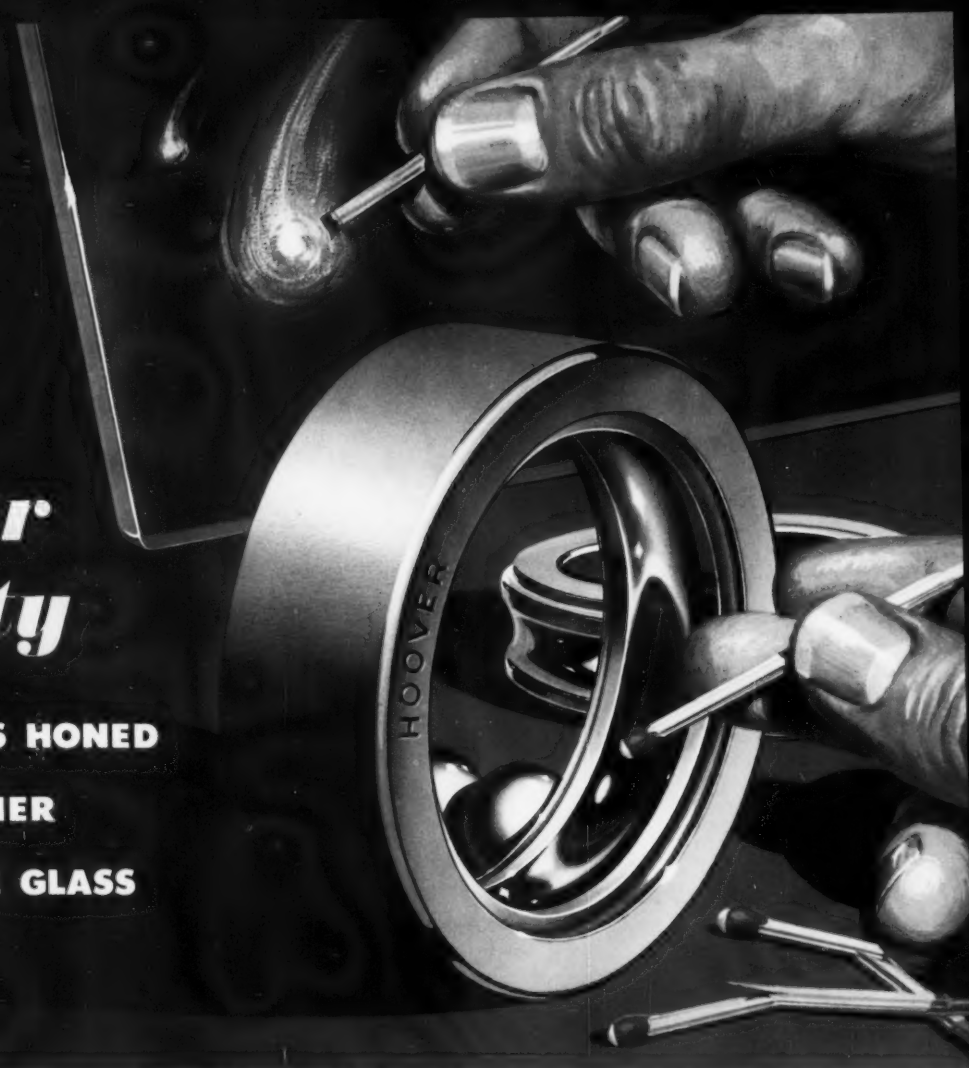
A.—Coolant is another aid in minimizing the heat problem and also increasing tool life. The important factor in using a coolant is the way in which it is applied and not the amount that is used nor even the type.

It is not the primary function of the coolant to take the heat out of the chip because the chip is thrown clear of the work and the cutter. Therefore, a large volume of coolant is not needed to put out the "fire." Instead, coolant should be applied where it is going to do the most good, and that is on the cutting edges of the cutter. Only a thin film of coolant is necessary to reduce the friction of the chips sliding over the face of the cutting tool. Also, the thin film of coolant acts as an insulator to further reduce the transfer of heat from the chip to the cutting edge of the cutter during the cutting process.

The best method for applying coolant accurately and effectively is to use several small high-pressure jets spraying at the cutting edge of the cutter from several points around the periphery of the cutter. A pressurized mist-coolant system is the best for this because it will eject a fine spray at a high velocity. The spray must have sufficient velocity to pierce through the turbulent air that the cutter creates when it is running at high speeds. If the coolant is applied in the proper manner, a small amount will go a long way and the shower that goes along with a large volume of flood coolant is eliminated.

To those industries where volume production of nonferrous parts is essential, this proved method of high-speed machining offers an entirely new concept in manufacturing. The data given here are based on more than twenty years' experience of Onsrud Machine Works, Inc., in developing high-speed machining methods for nonferrous metal parts and the engineering service it has made available to industry in this field.

Courtesy of Onsrud Machine Works, Inc., Niles, Ill.



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are carefully matched sets of *Micro-Velvet* balls which are accurate within millionths of an inch. These precision components work together in hushed quietness, an excellent indication of bearing quality and a characteristic of all Hoover bearings.

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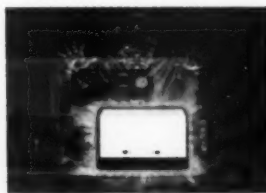
hoover CONTROLS hoover quality FROM START TO FINISH



Hoover's Cuyahoga Steel and Wire Division produces quality chrome alloy steel wire from which balls are made.



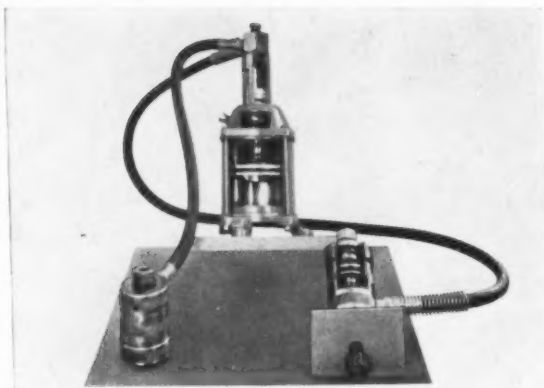
Micro-Velvet balls are products of Hoover Ball Division plants in Middletown, Ohio, and Erwin, Tennessee.



Non-destructive electronic testing devices check bearing parts for tolerance, hardness and hidden flaws.



Hoover bearings in a wide range of types and sizes always measure up to high *Hoover Quality* standards.



Midget PowRock clamp made by Wilton Tool Mfg. Co., Inc.

Wilton Midget PowRock Clamp

Booth 3838

A complete line of over four hundred power and manual clamping tools will be displayed by the Wilton Tool Mfg. Co., Inc., Schiller Park, Ill. Highlighting the display will be Wilton's new Midget PowRock. This power clamping tool is designed for securing such small items as electric and electronic parts, mechanisms, and aircraft and missile parts.

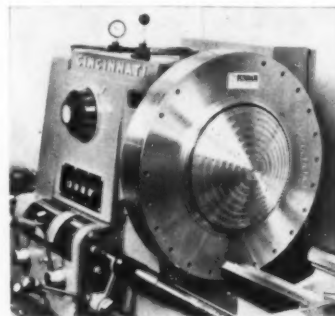
The RX-45 milling-machine vise—a new low-cost unit accurately machined to precision standards for smooth, positive clamping action—and the new Low-Boy PowRarm, a 5 1/2-inch positioner which brings the work closer to the bench and allows the operator to work faster, more accurately, and with less fatigue, will also be displayed.

Circle 612 on Readers' Service Card

Vacuum Chuck for Missiles and Aircraft

Booth 2610

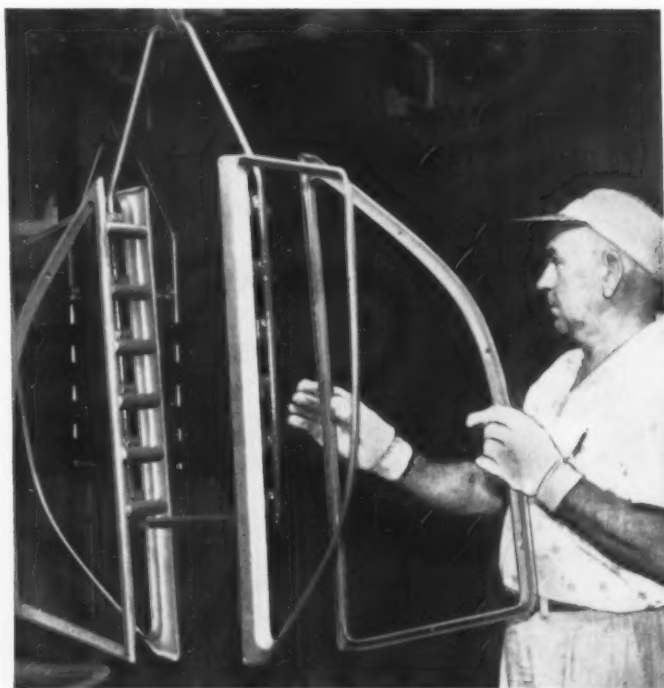
A vacuum chucking system for holding missile and aircraft components such as ceramic nose cones and stainless parts up to 100 inches in diameter will be displayed by the Dunham Tool Co., Inc., New Fairfield, Conn. Activated by a vacuum pump with hold-down pressure of 12 psi, the chuck develops over 33,000 pounds of distortion-free hold-down pressure on a 60-inch diameter part. An automatic safety device prevents loss of vacuum if power fails.



Vacuum chuck introduced by Dunham Tool Co., Inc.

Special designs permit boring inside diameters and facing and turning outside diameters concentric within 0.001 inch on parts up to 100 inches in diameter. Also, forgings and sand castings can be chucked with equal facility. Various models are available to fit 5 C Hardinge type lathes, J&L and Ex-Cell-O boring machines, Bullard vertical machines, Blanchard grinders, and practically all rotating type equipment.

Circle 613 on Readers' Service Card



Trim parts are being placed on a magnetic rack at a Chrysler Corporation assembly plant. The magnets have replaced pins, clamps, and hooks on conveyor lines servicing paint operations. Formerly, seventy-seven different styles of hangers were needed to handle various parts ranging in size from small trim moldings to 36-pound floor pans. Built to Chrysler specifications, the magnetic racks handle up to 38,000 parts per day in each of the company's assembly plants. A major advantage of the magnets is their ability to support parts on any point of contact.

Milling Machine Setup for Marking Dials

H. J. GERBER, Stillwater, Okla.

The graduating of various kinds of dials for experimental and other small-lot work sometimes does not justify the acquisition of production machinery, custom-made dies, or special one-application fixtures so often used for these operations. An improvised arrangement for stamping a neat and legible number sequence on work of this type is shown in Fig. 1.

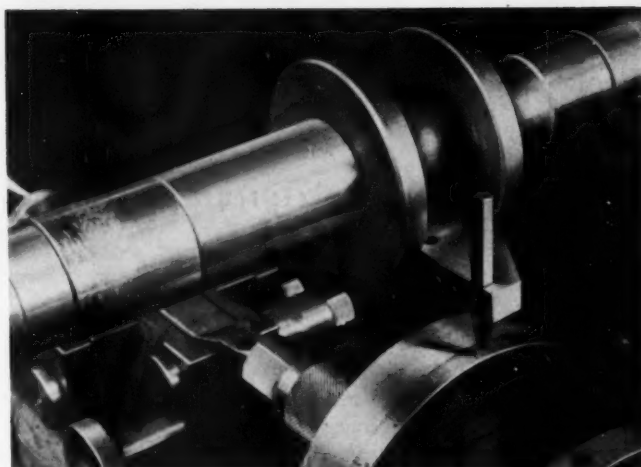


Fig. 1. Special stamp holder that can be set up on a milling machine to mark dials.



Fig. 2. Close-up of knurled discs used to clamp punch-holder.

The dial is held between dividing-head centers on a horizontal milling machine. A special, all-purpose stamp holder is then clamped between

two face-knurled discs (Fig. 2) mounted on the milling-machine arbor. Each stamp, in turn, is held and guided in a slot in this holder, which is aligned vertically over the work. Indenting is done by a sharp hammer blow on the stamp, the dial being rotated to desired position.

Made of tool steel, the stamp holder is hardened, and the slot is ground. A flat spring seats against one side of the stamp to retain it in place. The stamps used are standard, stock items which have been surface-ground on two opposite sides for proper fit in the slot. Each of the two clamp discs, which are made of mild steel, were case-hardened to prevent wear after the gripping surfaces were knurled.

Speeds and Diameters Calculated with Slide Rule

JAMES R. HANSEN, Bellevue, Wash.

The slide rule comes in handy for the rapid calculation of cutting speeds, revolutions per minute, and diameters. Either the "CI" and "D" scales or the "C" and "D" scales can be used. Answers for the various values appear opposite each other on the scales. For example, if the surface feet per minute is known, it is possible to match all diameters and revolutions per minute without moving the slide rule.

The use of the "CI" and "D" scales is preferred to the "C" and "D" scales. With the former, the values are interchangeable on the scales. Some slide rules, however, lack a "CI" scale; then the "C" can be substituted. A factor of 3.82 is used.

With "CI" and "D" scales

(1) To obtain rpm or diameter: Set given

sfp_m and 3.82 opposite each other on "D" and "CI" scales. Find rpm and diameter opposite each other on "D" and "CI" scales.

(2) To obtain sfp_m: Set given rpm and given diameter opposite each other on "D" and "CI" scales. Find sfp_m and 3.82 opposite each other on "D" and "CI" scales.

With "C" and "D" scales

(1) To obtain rpm or sfp_m: Set 3.82 on "C" scale opposite given diameter on "D" scale. Find rpm on "C" scale opposite given sfp_m on "D" scale. Or, find sfp_m on "D" scale opposite given rpm on "C" scale.

(2) To obtain diameter: Set 3.82 on "C" scale opposite given rpm on "D" scale. Find diameter on "C" scale opposite given sfp_m on "D" scale.

MICROHONING* pinion gears...

Simplifies processing, provides efficient production,

A major manufacturer of regular and compact cars has selected Microhoning as the most efficient method for securing consistent precision, controlled surface finishes, and simplified processing. Microhoning is used on the flat surfaces and bores of a number of transmission gears plus the O.D. of a housing hub. HERE'S HOW!

Flat-MICROHONING Simplifies Processing

Double surface Microflat machines simultaneously Microhone both flat surfaces of pinion and sun gears. First, the soft gear blanks are flat-Microhoned to secure thickness and parallelism within .0003", and a finish of 30 microinches (rms) or better. This simplifies subsequent operations by eliminating the former necessity of orienting the gears to a single finished surface.

The second flat-Microhoning operation occurs after the part has been bored, hobbed, teeth shaved, chamfered, and the gear has been heat-treated to a hardness of 59 R "C". This final flat-Microhoning quickly cleans up all burrs while generating required final accuracies and surface finish.

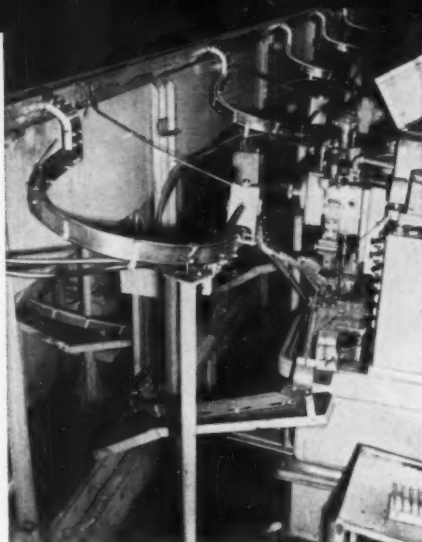
Efficient Production

After the second flat-Microhoning operation, gears are conveyed to Microhoners for processing the bores. Typical of the production efficiency realized on all gear bores is the bore-Microhoning of pinion gears (nine are used in each large transmission).

On eight Microhoners these pinion gears are automatically loaded, positioned, bores Microhoned, checked for size, segregated and ejected. This wholly automatic sequence takes about 18 seconds per gear. Only one set up man is required to keep all eight machines in operation.

An average of .002" stock is removed from each .504" D. x $\frac{3}{4}$ " L. bore; generated surface finish is 10 microinches, rms; roundness and straightness are held within .0001" tolerance; diameter within .0003".

The smaller transmission uses pinion and sun gears having various bore sizes (.697" D. x $\frac{3}{4}$ " L., .697" D. x $1\frac{3}{32}$ " L., 1.030" D. x $\frac{7}{8}$ " L.). To generate roundness, straightness, size and surface finish, these bores are



After the final flat-Microhoning operation, gears for use in large transmission are automatically conveyed overhead to a group of eight Microhoning machines, set up in two facing rows of four each. After bore Microhoning, finished gears are "tracked" to a lower conveyor which carries the part to the final operation of teeth polishing.

processed on five double-spindle Hydrohoners equipped with shuttle-type fixturing. Straightness and roundness are held within a .0003" tolerance, diametric size within .0005". All gear bores are processed in an average 26-second cycle that includes loading, Microhoning and ejection.

Microhoning is an efficient precision production process that assures consistent results. Also, reliable precision on component parts is a prime answer to "Why" better performing automatic transmissions are obtained.

*Registered U.S. Pat. Off.

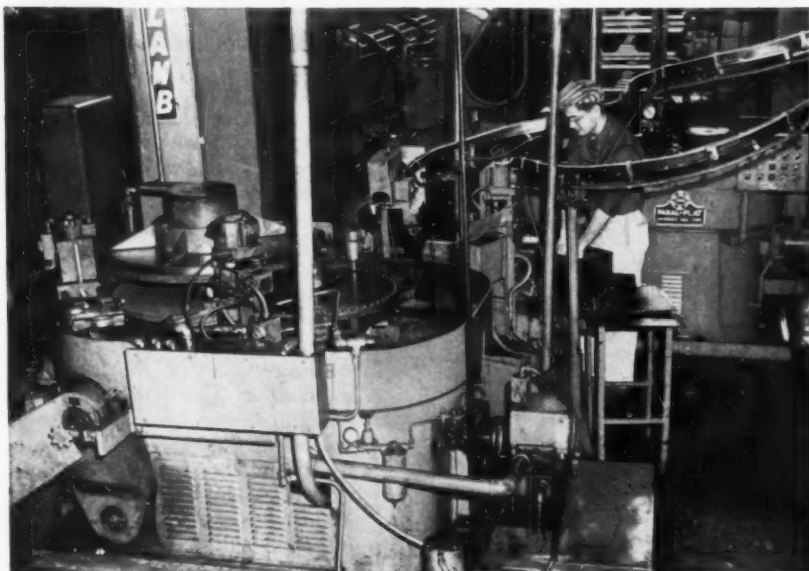
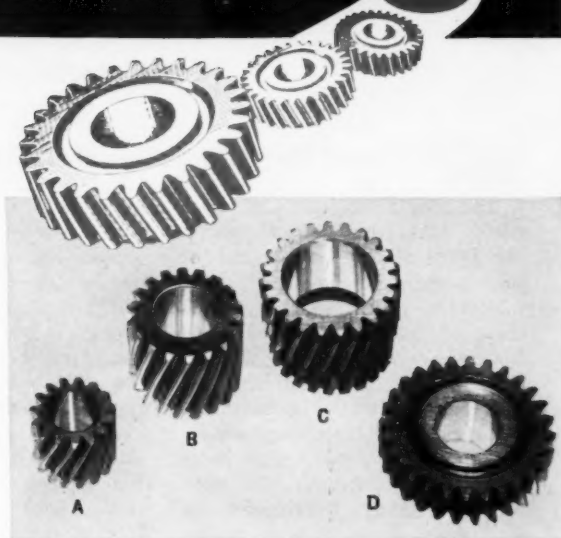


assures quieter-running transmissions

MICROHONING Increases Seal Life

In addition to flat surfaces and bores of gears, the converter housing hub of the large transmission is also Microhoned. Hub O.D. is 1.936", length is about 2", and it has a blind end with $\frac{1}{4}$ " relief. Two progressive Microhoning operations remove a total of about .004" stock to generate a surface finish of 15 microinches in a cycle time of 45 seconds per part.

During the last few strokes of the Microhoning tool in the finishing operation, the reciprocation is slowed down so that the surface finish lay marks run circumferentially around the hub. This pattern is specified so that the lay is in the same direction as the axis rotation of the oil seal which later will be assembled on the hub. This compatibility increases the life and effectiveness of the seal.



Types of gears Microhoned for automotive transmissions. Nine of gear 'A' are used in the large transmission, while three each of gears 'B' and 'D', and one each of gear 'C' are designed for the compact car transmission.



The two parts-chutes feeding the Paral-Flat machines encircle an operator who is checking parts. One machine handles the blanks, while the other does the flat-Microhoning operation following heat-treatment of the gears.

For further examples or information on the effectiveness of MICROHONING flat surfaces, bores or outer diameters, write to:

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

NEW DEVELOPMENTS IN

Machine tools, unit mechanisms, machine parts, and

Heald Precision Internal-Grinding Machine for Miniature Work

The Heald Machine Co., Worcester, Mass., has just announced the latest addition to its line of internal-grinding machines for miniature work. This new machine, designated the Model 090A, follows more than 200 similar earlier machines supplied by Heald since 1949. The improvements and developments resulting from this experience have been incorporated in the new model, making it exceptionally well adapted for a wide range

of miniature precision internal-grinding work.

Since the Model 090A machine has far fewer moving parts than earlier models, there is less to go wrong. Incremental wheel compensation, for instance, is infinite in a range from 0 to 0.001 inch, as opposed to random reliability from 0.0001 to 0.001 inch on other older models. The sensitivity of this control can materially improve wheel life so that the production per wheel will be in-

creased by 1000 or more pieces.

The construction of the new vibration-damped feeding cross-slide on antifriction ways provides a consistent repeatability accuracy well within 0.00001 inch. More efficient control and equipment arrangement is effected by complete accessibility through rear door panels for any service inspection necessary. No access is necessary from the ends of the machine so that equipment may be placed end-to-end.

Simplification has resulted in 75 per cent less hydraulic and electrical control equipment, with a cabinet size reduction of one-third and approximately one-half as many components. A new automatic cycle with the facility to swivel both the wheel-head (with respect to its line of traverse), as well as the work-head, significantly improves the accuracy of the work with respect to size and taper.

Change-over time has been substantially reduced on the new model by use of direct-reading micrometer type dials on all major adjustments. For instance, all cross-slide positions can be positively and directly set from data sheets without the use of a dial-indicator setup. To speed up wheel-changing time, the cross-slide is arranged for automatic resetting to the new wheel-dressing position. A direct-reading digital dial showing the amount of wheel life remaining at all times allows the operator to anticipate the time when the old wheel must be replaced by a new one. The work area is completely enclosed, but may be easily made accessible.

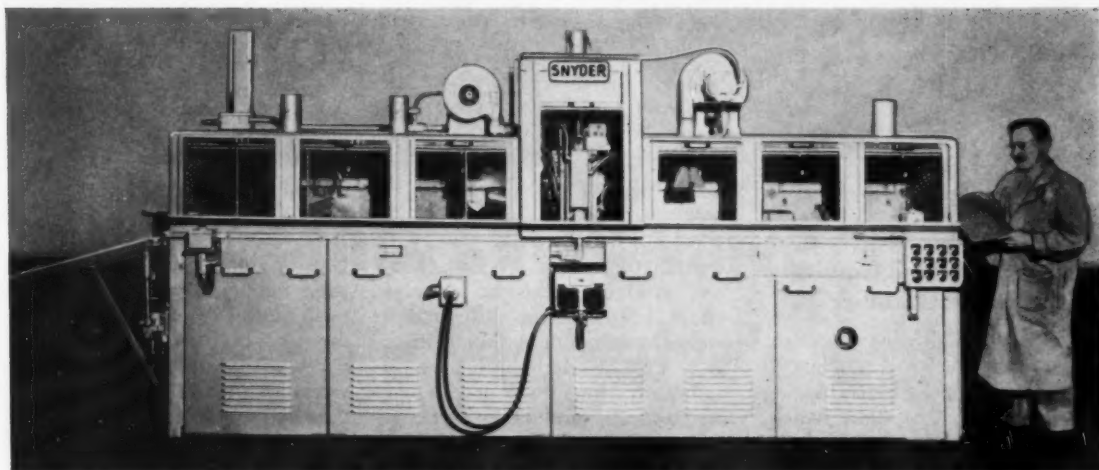
Circle 614 on Readers' Service Card



Internal-grinding machine for miniature work announced by Heald Machine Co.

SHOP EQUIPMENT

material-handling appliances recently introduced



Snyder automatic dip-solder machine that processes electronic printed circuit boards in a seventeen-second work cycle

Automated Machine for Dip-Soldering Printed Circuit Boards

An automated straight-line special machine that dip-solders electronic printed circuit boards at a cycle rate of one every seventeen seconds is now available from the Snyder Corporation, Detroit, Mich. This ten-station machine is designed to avoid hand or semi-manual fluxing operations as well as bridging and dross problems sometimes encountered.

The 12-foot long machine indexes the circuit boards from station to station by fingers on a stainless-steel roller chain. A hydraulic cylinder indexes the chain through a slip-clutch unit. The boards are manually loaded at the first station. In the second station, cellulose rollers apply a water-soluble flux to the underside of each board to avoid gumming and contamination problems. In Stations 3 and 4, drying of the top and bottom of the board is ac-

complished by a high-pressure warm-air blower.

Dip soldering is done at the fifth station. The temperature of the solder in the removable solder pot is held to a plus or minus 15-degree F. tolerance by electric heaters. The board is clamped to assure flatness and lowered by a hydraulic cylinder for a few seconds into the pot to a fixed depth. This controls the capillary action that causes solder to fill in around each wire lead. The dross is removed from the solder pot by a surface wiper that operates automatically at the completion of each dipping sequence.

The board is cooled in the sixth station, where another blower circulates air at ambient temperature to prevent heat of soldering from damaging critical electronic components. In the seventh station the board is washed with a

140-degree F. recirculating detergent solution and scrubbed with rotating, reciprocating brushes. Pressurized detergent flows through nozzles above and below the board while the brushes polish the circuitry.

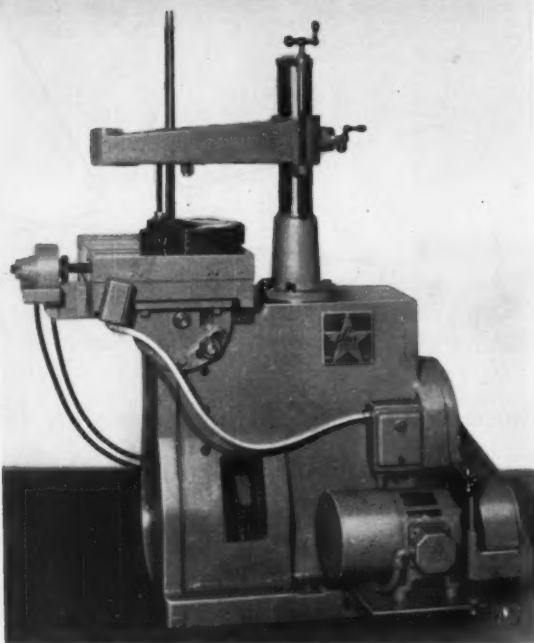
In the eighth station the board is rinsed with warm water and scrubbed with another rotating, reciprocating brush. Air flows through nozzles from a three-stage blower to dry the board at the ninth station. The transfer chains are washed at the same time as the boards and thus kept in a clean, unlogged condition.

The boards slide out of the chain automatically into a chute at the tenth station, where they are inspected and manually loaded into portable pallets. The entire machine is provided with a vented bonnet to carry away fumes. Sliding glass panels in the bonnet permit visual inspection and access at each station.

Circle 615 on Readers' Service Card



Testing chamber made by Cincinnati Sub-Zero Products



Improved Star keyseater with automatic feed arrangement

Temperature and Humidity-Testing Chamber

Cincinnati Sub-Zero Products, Cincinnati, Ohio, has announced the addition of humidity testing to its already popular bench-model temperature-testing chamber. The new chamber (SUB-Z-H) is available in 2-, 4-, and 8-cubic-foot sizes, with temperature ranges of minus 100 to plus 400 degrees F. and a humidity range of 20 to 95 per cent.

The illustrated model has an illuminated stainless-steel chamber which affords a net test area of 14 by 14 by 14 inches, and the cabinet exterior measures 40 inches high by 24 inches wide by 29 inches deep. Temperature and humidity conditions are controlled by wet- and dry-bulb indicating controllers, and an even temperature is accomplished by means of an 8-inch air circulator with a fin coil evaporator. The door may be hinged right or left, and includes a 12- by 12-inch frost-free, multiple-pane window. Other optional features include terminals, ports, and programming controllers.

Circle 616 on Readers' Service Card

Precision Keyseater

An improved Model No. 0 compact keyseater featuring an automatic feed arrangement is now available from the Star Cutter Co.,

Farmington, Mich. This machine will produce precision keyways up to 1 1/4 inches wide and 9 inches long in a minimum of time. It is ideally adapted for use in toolrooms and on low- and medium-rate production parts.

Keyways are produced with standard, stocked high-speed-steel cutters from 1/8 to 1 1/4 inches wide that are wedge-locked in a cutter bar. The bar, which travels up and down, is supported at the top by a bushing in an overarm. The work-table is fed in toward the cutter automatically when the cutter-bar is at the top of the stroke. It backs out at the bottom of each stroke to clear the tool.

The cutter-bar assembly consists of a guide bar and a cutter-bar into which the cutter is locked. The cutter-bar is clamped in the ram underneath the work-table with a split support bushing. To remove the work-piece from the table, the guide bar is unscrewed from the cutter-bar with a special wrench and raised. This permits the work to be removed from the table with the end of the cutter-bar. Another part is then loaded into the clamping position. The column rarely has to be raised in order to permit removal of the work-piece.

An electric motor drives the ram through a V-belt, two spur gear trains, and an adjustable eccentric motion. An electric brake

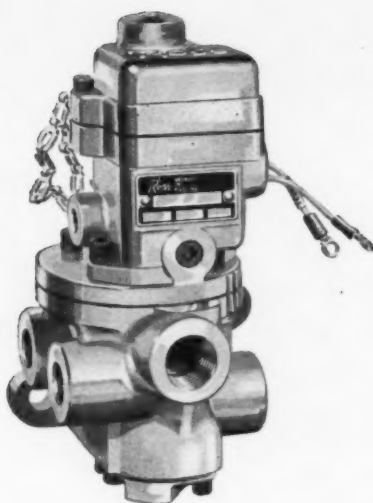
on the motor provides for quick stops or jogging functions with a push-button control. An air valve operated by a cam on the eccentric shaft controls the automatic work-table feed through air cylinders and a lead screw.

The keyseater is powered by a 1 1/2-hp motor. Cutter-bar speeds of fifteen and thirty-three strokes per minute are obtained by a V-belt and step-pulley arrangement. Table feeds are adjustable from 0.001 to 0.012 inch per stroke. Cutter-bar stroke is adjustable from 3 1/4 to 9 inches by setting an eccentric offset.

The machine has a 17- by 18-inch T-slot table and a two-position overarm column that can be moved to a forward position so that large spoked gears can be located around the column. The precision sliding ram travels in accurate, scraped ways, and an overarm bushing support that provides maximum work accuracy avoids work chatter and maintains keyway alignment.

Standard stocked two-piece cutter-bar assemblies from 1/2 to 1 5/16 inches in diameter are used. Accessories for the machine include outside- and inside-diameter centering plates with removable bushings, and two sizes of work-clamping bars. The machine occupies a floor space of approximately 33 by 52 inches.

Circle 617 on Readers' Service Card



**this small valve
can do a big valve's work**

Ross

NEW "HEADLINE" SERIES

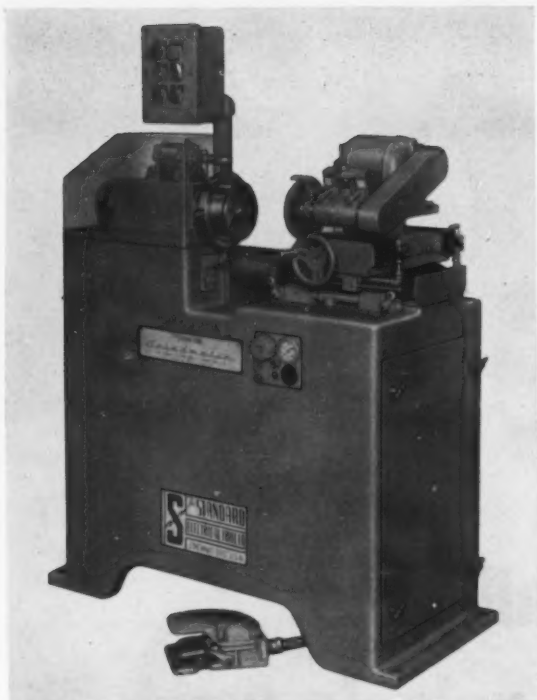
This story has made the Ross Headline valve series a "standard" in the world of valvedom in just six short months. There is nothing "exotic" about it. Our designers and manufacturing engineers have simply been able to create an economical inline valve that will pass a greater volume of air, valve size-for-valve size, than any other valve made. The Headline valve thus in many instances permits you to use a

smaller valve than you could use before. Since this has been done without compromising Ross traditional quality, and long-life is thus taken for granted, the "Headline" series then represents probably the best valve value available today. Straightways, 3-ways and 4-ways. Pipe sizes, $\frac{1}{4}$ " through $1\frac{1}{2}$ ".

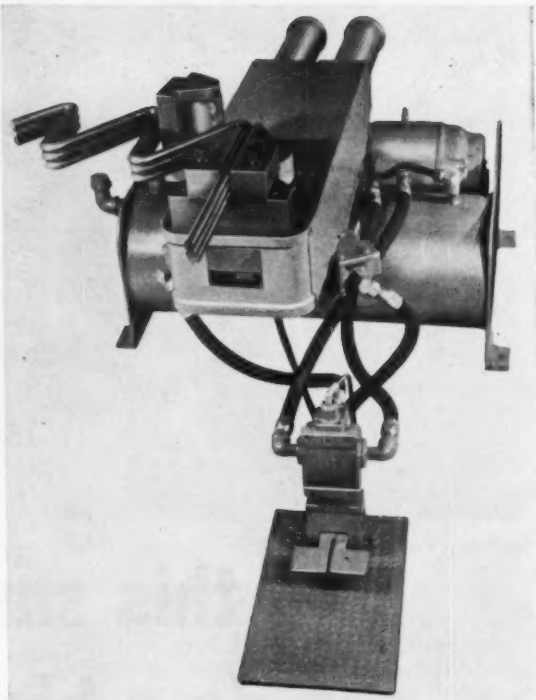
Call your Ross representative or write for Bulletin 323.

For other Ross valves see our catalog in Sweets Product Design File.

Ross OPERATING VALVE COMPANY
110 EAST GOLDEN GATE AVE. • DETROIT 3, MICHIGAN



Specially designed versatile grinder of building-block type built by Standard Electrical Tool Co.



Open-web joist and stirrup clockwise and counterclockwise bender built by Wallace Supplies Mfg. Co.

Versatile Grinder of Building-Block Design

The Standard Electrical Tool Co., Cincinnati, Ohio, shows in the accompanying illustration an example of the "endless versatile variations" possible with its building-block line of superprecision spindles, grinder heads, slides, feeds, accessories, etc. While this machine is of individual design for a specific application, it is instantly adaptable to a wide range of precision internal and external grinding work. The grinding wheel-head, powered by a 1/2-hp motor, allows for instant interchange of the 6-inch wheel external spindle for a wide range of interchangeable internal spindles.

The manual cross-feed will adjust the wheel-head for internal grinding or a maximum of 6-inch external grinding. The headstock is available in a wide range of designs—internal taper, external taper, through hole in the spindle, and with all types of work-holding equipment. The illustration shows the headstock equipped with a collet chuck having an automatic air cylinder. Collet opening and

closing is controlled through the foot-pedal switch.

The switch panel (pendant type) allows for manual or completely automatic operation, including either continuous headstock rotation with work inserted and withdrawn from rotating collet chuck, or cyclical instant start-stop of work-head through a built-in electrical brake.

Horizontal traverse is powered by a hydraulically controlled air cylinder. The dovetail slide with nonmetallic ways has oil-grooves and gravity oilers. The ways are protected by accordion type guards. The adjustable trip rod with limit and solenoid switches permits continuous reciprocation with variable traverse speed and variable stroke from 0 to 8 inches, or greater, if required.

The removable door with quick-acting latches, as illustrated at the right, allows for instant access to the complete automatic cycle panel serving both the electrical and hydraulically controlled air units.


Circle 618 on Readers' Service Card

Joist and Stirrup Bender

A machine now being used for bending the web in the steel joists used to support floors and roofs in building construction, as well as the stirrups used to support the joists, is now available from the Wallace Supplies Mfg. Co., Chicago, Ill. This bender, designated the Wallace No. 35, drives under full power both clockwise and counterclockwise (right or left). It is operated by one hydraulic foot-valve, permitting the operator full use of his hands for positioning the work prior to bending. Two adjustable stops for clockwise and counterclockwise bending are supplied.

The machine has a maximum capacity for bending two 3/4-inch round bars. It has a rating of 5 hp and a speed at the bending head of 13 to 15 rpm. Minimum radius to near edge is one-half the bar diameter. Height of table top to floor is 28 1/4 inches. The floor space required (no allowance for swing) is 58 by 38 3/4 inches. The weight is 1850 pounds.

Circle 619 on Readers' Service Card



At AUTONETICS, a division of North American Aviation, Inc. . . .

**Close tolerance jig boring
of intermediate gimbals
for N5G inertial autonavs
in GAM-77 air-to-surface missiles...**

means

Bores of .0002" diameter and within .0005" in lineal dimensions, bored in three locations at 0-90° and 180°, holding .0005" parallel and .0005" concentricity.

Bores also held normal to each other within .001" total internal radius.

and that means...

**an economical production run on
LINDNER OPTICAL MEASURING
JIG BORER Model LB15
with exclusive Autopositioner**

Your close tolerance jig boring
belongs on a LINDNER, too.
May we show you
all the reasons why?



KURT ORBAN
COMPANY, INC.

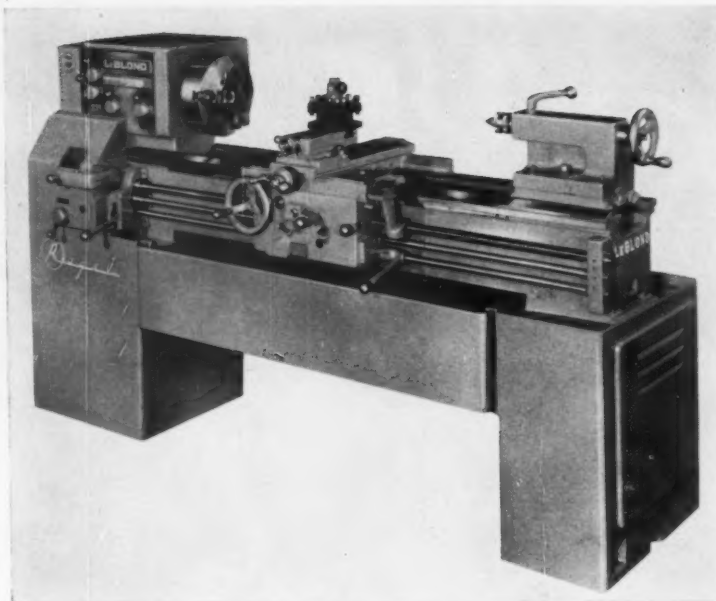
34 Exchange Place, Jersey City 2, New Jersey

LeBlond Redesigned Lathes

The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has announced the redesign of its entire line of Regal lathes. This modernization program affects ten different models ranging in capacity from 13 to 24 inches. The line includes 13-, 15-, 17-, 19-, 21-, and 24-inch models. In addition, there are 17- and 19-inch plain bed-gap and 17/28-inch and 19/28-inch sliding bed-gap models.

New design features are particularly apparent in the headstocks, which have all undergone a transformation in controls to unite maximum ease of operation with maximum efficiency. The lathes incorporate many heavy-duty features not ordinarily found in low-cost lathes. Among them are heavy three-bearing spindles, automatically lubricated and totally enclosed quick-change boxes, motor enclosed in head leg, and compensating V-ways to provide accurate carriage guidance and properly distribute cutting forces.

A complete line of accessories is available, including Regal



Regal 15-inch lathe of redesigned line announced by LeBlond

Trace, which works from simple, low-cost, flat templates. Also, the 13- and 15-inch Regals are available with cabinet bases which provide 5-cubic-foot storage space.

Circle 620 on Readers' Service Card

inhibits the entrance of grinding dust and facilitates the delicate sharpening of tiny tools as small as 1/32-inch and up to 1 1/4-inch shank capacity sizes. The milling-cutter sharpening range is through the 6-inch diameter size; and any style, such as side mills, stagger teeth, etc., may be sharpened.

Circle 621 on Readers' Service Card

End-Mill Sharpening Fixture

An ultraprecise end-mill and milling-cutter sharpening fixture, called the Air-Flo, which has a spindle that floats on a cushion of air, has been introduced by the Harig Mfg. Corporation, Chicago, Ill. The sensitive spindle floats on less than 0.00015-inch film of air. Other features are a finely graduated gooseneck tilting and

swivel base; fine blade-rest adjustment; hard chromium inlay; and indexes and components to grind tapered end mills, as well as for straight grinding.

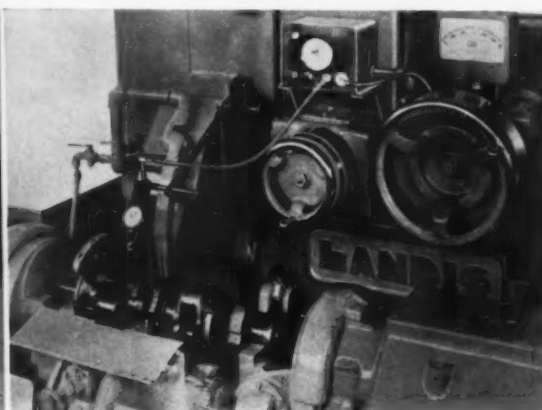
The supersensitive air bearing, for which a patent is pending, speeds sharpening of end mills, routers, and virtually all types of milling cutters. The flow of air

Federal Control Gage

A single-limit control gage for cylindrical grinders, known as the Econo-Sizer, is announced by the Federal Products Corporation, Providence, R. I. This gage is a



Air-Flo end-mill and milling-cutter sharpening fixture



Econo-Sizer control gage for cylindrical grinders

CUTS MANUFACTURING COSTS OF EXPORT PARTS TO MEET FOREIGN COMPETITION

Assignment was to design and build a machine to process large domestic aluminum transmission covers through one sequence of operations and smaller export covers through a different sequence. One machine to do both jobs would, naturally, save money. The job was slightly complicated by production ratio of one export part to four domestic; the machine to accept these parts intermixed at random and run them through automatically.

The assignment was carried out successfully and covers made here are built into foreign cars at cost competitive with local production overseas.

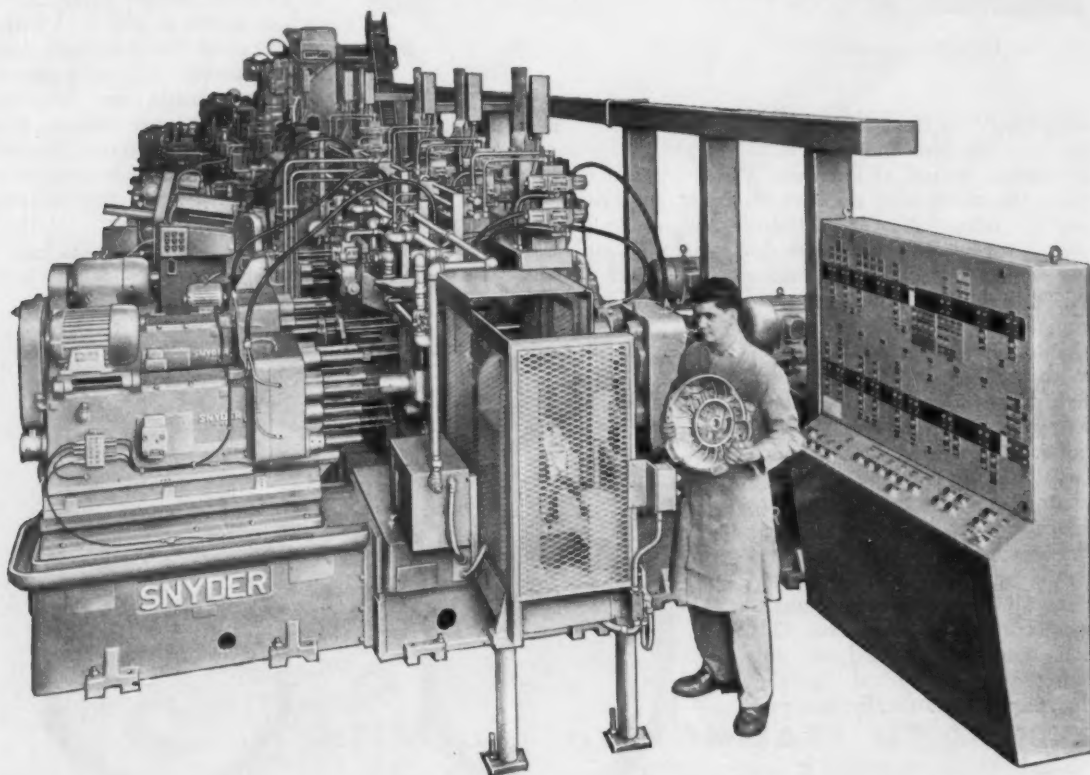
The fact is that U. S. experience, know-how, fresh approach and creative ideas *can build and are building* machines to offset foreign cost advantages. And

the same cost-cutting techniques can be built into machines to offset regional manufacturing cost differences. Here at Snyder we're particularly experienced in this because we've been designing and building such machines for both domestic and export markets for 35 years. May we help you?

SNYDER **CORPORATION**

3400 E. LAFAYETTE—DETROIT 7, MICHIGAN

Phone: LO 7-0123



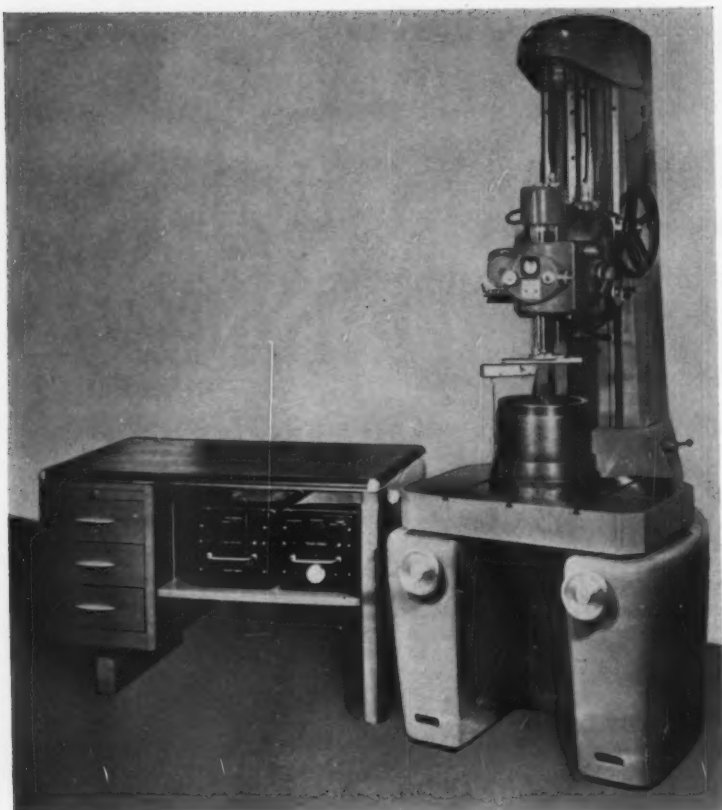


Fig. 1. Talyrond roundness-testing instrument with electronic equipment

simplified "Air-Electric" unit that provides effective and reliable dimensional control at low cost. A power-handling relay operates directly from the Air-Electric switch to initiate the control signal which retracts the grinding wheel. A built-in fail-safe feature provides a finish-size signal should there be a power failure. With the Air-Electric gaging system, there is cushioned response to work-size variations, so that minor surface irregularities which could improperly influence the control action of the gage do not affect it.

The compact cabinet measures only 8 by 6 by 7 inches, yet contains all the necessary elements for accurate grinder control. This gage can be installed on any plunge-cut cylindrical grinder that has a hydraulically powered

wheel-slide mechanism. The Econo-Sizer can be supplied with either the familiar Arnold grinding gage caliper or any suitable caliper designed for air measurement.

Circle 622 on Readers' Service Card

Precision Roundness-Measuring Instrument

The Engis Equipment Co., Chicago, Ill., has announced a Model 2 Talyrond precision roundness-testing instrument for missiles and space vehicles, as well as for use in automated production lines. The precision vital for direction of space vehicles and atomic submarines is equally important in less-glamorous day-to-day problems of checking bearings, transmissions, and crankshafts for automobiles; compressors for refrigerators; and a wide variety of similar components.

The Model 2 Talyrond roundness-measuring instrument, Fig. 1, has a work-table designed to carry components weighing up to 1000 pounds and shafts measuring up to 50 inches in length. When necessary, the work-table can be removed to provide additional work capacity.

Measurements of roundness, concentricity, coaxiality, squareness, and interrupted circular shapes are permanently recorded on Talyrond inkless polar charts, such as shown in Fig. 2. A major advantage of this electronic master instrument is that measurements are made and recorded while the test piece remains in a fixed position. Therefore, the rotating spindle of the instrument is not affected by the size, balance, or shape of the work.

Circle 623 on Readers' Service Card
(This section continued on page 198)

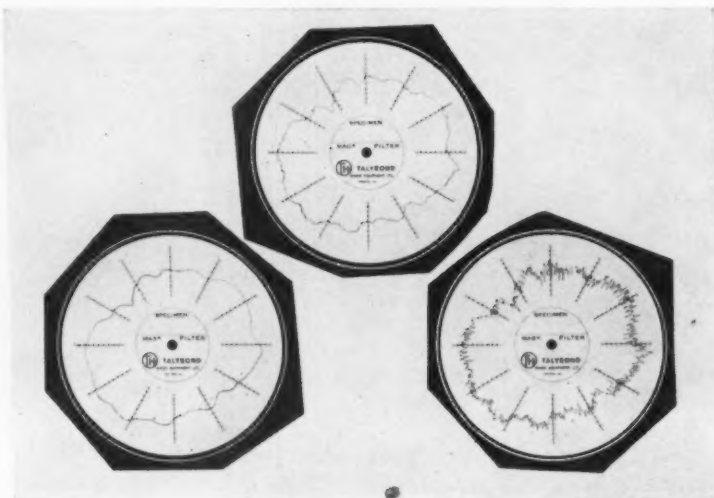


Fig. 2. Typical polar graphs made on Talyrond instrument, Fig. 1



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NEW CATALOGUES

Isabel Shamlian
Charles O. Herb, Jr.



Catalogues bring details of new products to prospective buyers in clear, concise form. Yours for the asking . . . use postcard inside back cover



Grinders

Landis Tool Co., Waynesboro, Pa. Bulletin 6RP-60 providing data on the Landis 6-inch Type R and 10-inch Type LR semiautomatic plain cylindrical grinders. Condensed specifications plus standard equipment and equipment at extra cost are included.

Circle Item 501 on Inquiry Card



Arc-Welding Products

Lincoln Electric Co., Cleveland, Ohio. Bulletin 7000.7 containing information on the company's line of arc-welding products. Covered are data on AWS electrode classification and the correct electrode selection for every type of welding application.

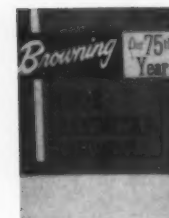
Circle Item 502 on Inquiry Card



Rotary Indexing Tables

Michigan Tool Co., Detroit, Mich. Data Sheet X60-A describing the Milichex rotary indexing table, designed for precision work with small work-pieces, which provides whole-degree angular indexing with an accuracy of 1/4 second of arc.

Circle Item 503 on Inquiry Card



Power Transmission Equipment

Browning Mfg. Co., Maysville, Ky. Catalogue GC-101-F covering details on the company's complete line of power transmission equipment, including V-belts, a malleable-iron bushing system, and a comprehensive line of roller chains and sprockets.

Circle Item 504 on Inquiry Card



Coated Abrasive Products

Carborundum Company, Niagara Falls, N. Y. Catalogue listing standard coated abrasive products used throughout industry. All items included are maintained in stock at Carborundum warehouses by electronic order processing and inventory control.

Circle Item 505 on Inquiry Card



Metalworking Equipment

Di-Acro Corporation, Lake City, Minn. Catalogue No. 61 covering details on hand- and power-operated Di-Acro precision metalworking machines. Also listed are single-station and adjustable punches and dies, standard vee type press-brake dies, etc.

Circle Item 506 on Inquiry Card



Lathes

R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Bulletin No. R-206 telling the story of the 21- and 24-inch Regal engine lathes. Descriptions and specifications of Regal 21- and 24-inch plain and sliding-bed gap lathes are also included.

Circle Item 507 on Inquiry Card



Titanium

Republic Steel, Cleveland, Ohio. Bulletin No. 5 on the resistance of titanium to corrosion due to galvanic action; stress; molten metals; organic and inorganic acids, bases, and compounds; etc. A table of titanium properties is included.

Circle Item 508 on Inquiry Card



Zinc Die Castings

New Jersey Zinc Co., New York City. Bulletin on a variety of applications for zinc die castings—household and business equipment, hardware, industrial and automotive equipment, music and communications parts, photographic supplies, etc.

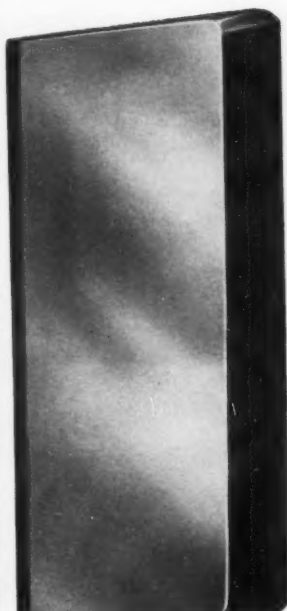
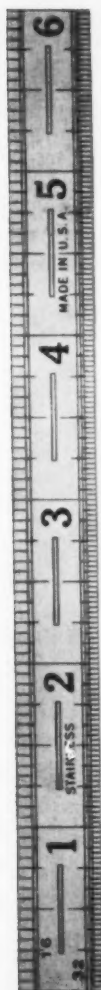
Circle Item 509 on Inquiry Card



Grinding Wheels

Simonds Abrasive Co., Philadelphia, Pa. Bulletin ESA-141 giving a description of general-purpose grinding wheels. Included are grain and grade specifications and reference to Red Center plastic reducing bushings for quick change of arbor hole sizes.

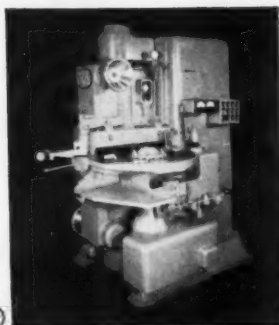
Circle Item 510 on Inquiry Card



Tungsten carbide rock drill insert ground on Besly DV 2 Grinder. Courtesy Adamas Carbide Corporation, Kenilworth, New Jersey.

GRINDS FIFTY **3 1/2"** CARBIDE BITS PER HOUR

BESLY DV 2
DOUBLE VERTICAL GRINDERS



■ The Besly DV2 is designed for tough production grinding jobs and this job—tungsten carbide inserts for mining drills—is the toughest it's met yet. The DV2 took the job in stride, and kept well within tolerances of .004" for size, .005" for flatness and .002" for parallelism.

The DV2 using resinoid-bond abrasive discs—also grinds parts ranging from .050" to 2 1/2" in thickness and .375" to 3" in diameter including ceramics, stampings, plastic parts, alnico magnets, bearing races, coil springs, and carbon parts.

Write for this new illustrated catalog of Besly Production Disc Grinders.



BESLY-WELLES CORPORATION

120 DEARBORN AVENUE, SOUTH BELOIT, ILLINOIS

Grinders and Abrasives • Taps • X-Press® Taps • Drills • Reamers • End Mills • Tool Bits • Gages • Carbide Tipped Tools • Blanks • Inserts • Holders

MACHINERY, May, 1961

For more data circle this page number on card at back of book

185

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Motor-Driving Unit

Reliance Electric & Engineering Co., Cleveland, Ohio. Catalogue G-100 covering Reeves variable-speed, 1/4- to 40-hp Motodrives. Speed and horsepower tables, right-angle reducer capacities, dimensions and assemblies, etc., are featured.

Circle Item 511 on Inquiry Card



Metal-Cutting Tools

Greenleaf Corporation, Newcomer Tool Division, Pittsburgh, Pa. Catalogue 161 containing details on the company's complete line of tool-holders, milling cutters, locking wedges, and special tooling. Specification tables and diagrams are provided.

Circle Item 517 on Inquiry Card



Grinder

Star Cutter Co., Farmington, Mich. Catalogue Sheet SC-154 presenting the Star No. 3 profile grinder, a floor type tilting-table machine that grinds or polishes contours and irregular shapes. A list of accessory equipment is also included.

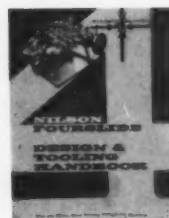
Circle Item 512 on Inquiry Card



Drills

American Twist Drill Co., Detroit, Mich. Catalogue No. 960 presenting the company's high-speed-steel, carbide-tipped, and solid-carbide twist drills. Specifications for each type are given in chart form, along with a separate price list.

Circle Item 518 on Inquiry Card



Metal-Forming Machines

A. H. Nilson Machine Co., Shelton, Conn. Brochure containing information on wire- and ribbon-metal forming "Fourslide" machines. Wire-end treatments, forming of "eyes" on wire, miscellaneous metal forms, and coiling (or winding) are covered.

Circle Item 513 on Inquiry Card



Spiral Bevel Gears

Perkins Machine & Gear Co., West Springfield, Mass. Catalogue giving full specifications on spiral bevel gears—speed ratios, sizes, and horsepower ratings. The teeth are hardened and lapped and the bores are left soft for reworking.

Circle Item 519 on Inquiry Card



Numerically Controlled Machine

Kearney & Trecker Corporation, Milwaukee, Wis. Bulletin No. MM-3 featuring details on the Model III Milwaukee-Matic numerically controlled machine, which unifies face milling, end milling, drilling, reaming, tapping, boring, counterboring, etc.

Circle Item 514 on Inquiry Card



Tapping Machines

Kaufman Mfg. Co., Manitowoc, Wis. Bulletin featuring the Model 10E-20 tapping machine. In addition, pictorial examples of work done on various Kaufman machines, with data and descriptions of Models 10E-126 and 10E-1125, are provided.

Circle Item 520 on Inquiry Card



Retaining Rings

Industrial Retaining Ring Co., Irvington, N. J. Catalogue No. 31 providing data on the Industrial Series 3100 prestacked external retaining rings, available in 0.250- to 1.375-inch sizes, which are axially applied. A sample is included.

Circle Item 515 on Inquiry Card



Bending Presses

Pines Engineering Co., Inc., Aurora, Ill. Bulletin No. 379 describing the firm's complete line of bending presses that are especially designed for fast bending of a variety of parts made of tubing, pipe, rod, bar, and certain shaped stock.

Circle Item 521 on Inquiry Card



Clamp Assemblies

Accurate Bushing Co., Garwood, N. J. Catalogue No. JF-61 containing complete data on the firm's line of clamp assemblies and fixture components. More than 1000 ABC clamp-assembly and fixture-component items are available from factory stock.

Circle Item 516 on Inquiry Card



Radius Blocks

Parker-Hannifin Corporation, Cleveland, Ohio. Catalogue 4390 describing tube bend radius blocks conforming to Military Standard MS 33611. Henceforth, only the blocks to the new standard will be priced as standard stocked parts for immediate delivery.

Circle Item 522 on Inquiry Card

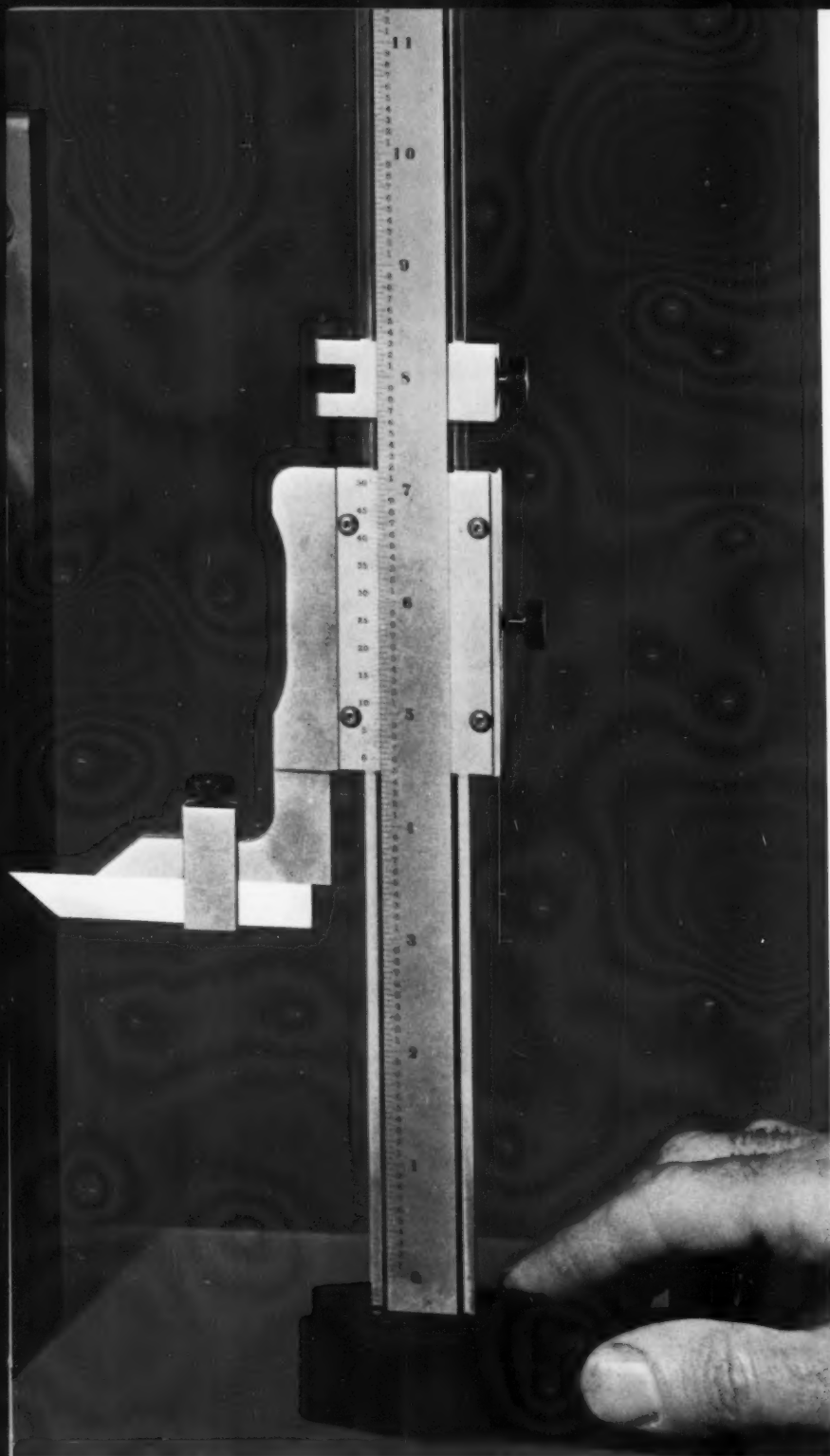
NEW lighter weight Starrett® SATIN-CHROME master vernier height gage

In the new, popular priced, No. 255 Series Flush-Reading Master Vernier Height Gage, Starrett presents a lighter weight companion to the No. 254 heavy duty Master Vernier Height Gage.

Combining just the right balance and weight for precise, effortless handling, it features a new, open-face, easy-reading design with long, widely-spaced, 50-division vernier flush fitted to eliminate parallax errors; hardened and stabilized master bar with combination straight and angular ways; new hand-fitting, natural grip base; full range direct reading; no-glare SATIN-CHROME finish on all reading surfaces . . . plus many other precision features.

Ask your nearby Industrial Supply Distributor to show you new Starrett No. 255 Master Vernier Height Gage. Call him for any of the more than 3,500 quality products in the complete Starrett line or write for Catalog No. 27. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts, U.S.A.

World's Greatest Toolmakers

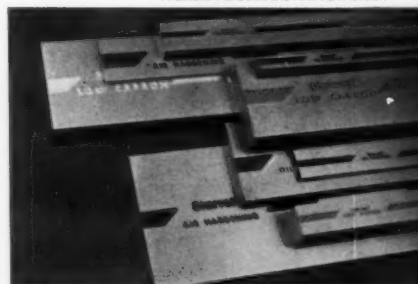


PRECISION TOOLS — New No. 255 Series Master Vernier Height Gage. Available in 12" and 18" SIZES.



Visit the Starrett Exhibit
BOOTH 1214 - ASTME SHOW

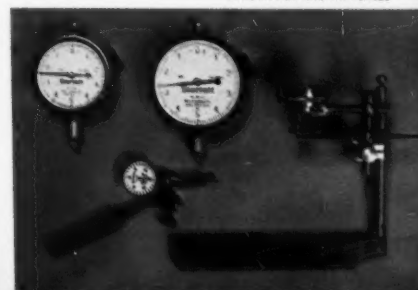
PRECISION GROUND DIE AND FLAT STOCK



HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES



DIAL INDICATORS AND GAGES



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Welded Steel Tubing

Epps Industries, Inc., Los Angeles, Calif. Brochure giving a list of applications for round and square welded steel tubing. Included is a discussion of the tolerances permissible in bending, swaging, flanging, or punching welded tubing in the fabrication of products.

Circle Item 523 on Inquiry Card



Surface Equipment

Challenge Machinery Co., Grand Haven, Mich. Catalogue No. 840 giving specifications on over 400 types of precision surface equipment. Included is expanded information on granite surface-plate equipment and new data on semisteel angle-plates.

Circle Item 529 on Inquiry Card



Drilling Tools

Dumore Co., Racine, Wis. Bulletin D-60-C containing brief descriptive details, ordering information, and data on how to use Dumore portable precision drilling tools—including "Drill-N-Tap" and "Hi-Speed" units—for holes from 0.001 to 3/8 inch.

Circle Item 524 on Inquiry Card



Relief-Grinding Fixture

Harig Mfg. Corporation, Chicago, Ill. Catalogue describing the firm's "Steptool" fixture for drill pointing and cam-relief grinding. Also discussed are cam adjustments, how to locate tools in the fixture, grinding flutes, Helix-points, etc.

Circle Item 530 on Inquiry Card



Laminated Plastics

Taylor Fibre Co., Norristown, Pa. Catalogue giving basic application information and engineering data on the company's laminated plastics and Tayloron vulcanized fiber. NEMA grades, military specifications, color, forms, and sizes are covered.

Circle Item 525 on Inquiry Card



Thumbscrews and Plungers

Vlier Engineering Corporation, a subsidiary of Barry-Wright Corporation, Los Angeles, Calif. Catalogue sheet briefly describing the firm's swivel-pad torque thumbscrews, stainless-steel ball plungers, leveling pad, and hardened ball buttons.

Circle Item 531 on Inquiry Card



Deburring and Buffing Machines

Acme Mfg. Co., Detroit, Mich. Catalogue AM-52 on a line of semiautomatic machines for low-production deburring, buffing, and polishing operations, and accessories and attachments for increasing efficiency of semiautomatic finishing operations.

Circle Item 526 on Inquiry Card



Trolley Conveyors

Link-Belt Co., Chicago, Ill. Book 2730 on trolley conveyors, giving examples of installations—from small, relatively simple jobs up to the most complex systems. Also shown is how trolley conveyors aid in washing, finishing, drying, baking, etc.

Circle Item 532 on Inquiry Card



Flaw Detector

Branson Ultrasonic Corporation, Stamford, Conn. Brochure covering the Sonoray Model 5 portable ultrasonic flaw detector, which is used for flat-plate, livestock, pipe and tubing, weld, nuclear-fuel element, circular-casting, and rod applications.

Circle Item 527 on Inquiry Card



Stampings and Dies

Kalamazoo Stamping & Die Co., Kalamazoo, Mich. Folder on the firm's operations in the stamping and die field. Included are illustrations of die-making and production equipment in operation, plus a listing of toolroom and production equipment.

Circle Item 533 on Inquiry Card



Multiple-Spindle Automatics

Warner & Swasey Co., Cleveland, Ohio. Portfolio containing details on metal-cutting jobs run on the firm's multiple-spindle automatics. Featured are dozens of different work-pieces and tooling applications, with line drawings and setup-sheet data.

Circle Item 528 on Inquiry Card



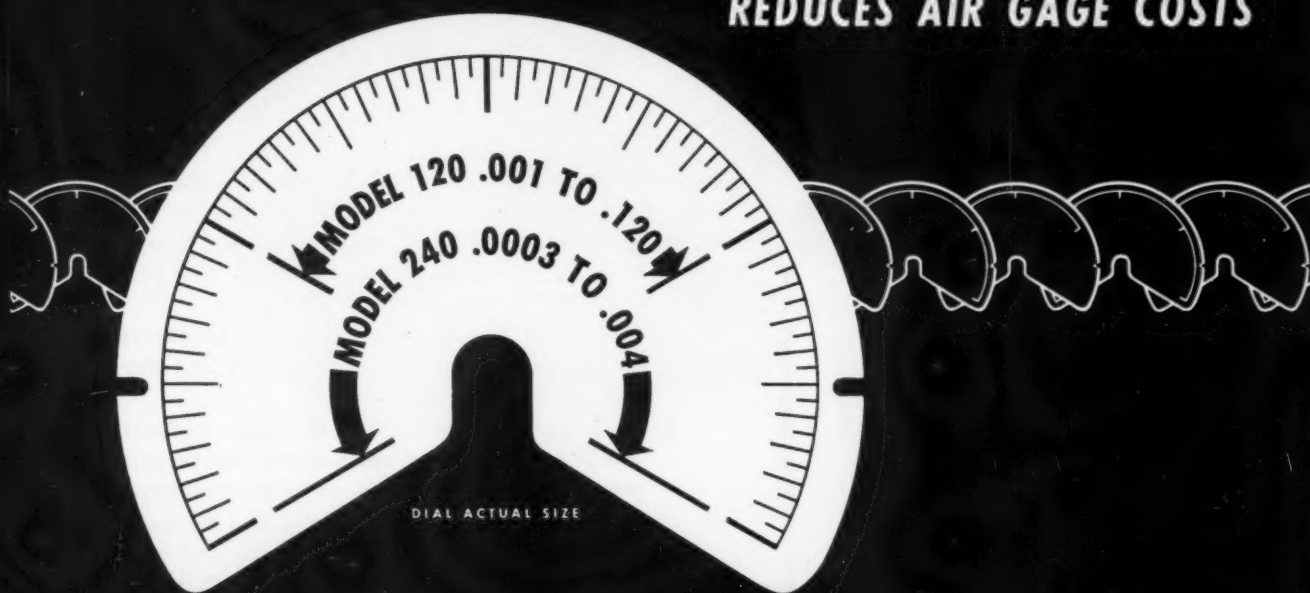
Toggle Clamps

Wespo, division of Vlier Engineering Corporation, Detroit, Mich. Catalogue 61-A listing prices for toggle clamps and pliers, adjustable spindle with bonded neoprene cap, adjustable hold-down spindles, neoprene caps, Adjusto-Matic accessories, etc.

Circle Item 534 on Inquiry Card

ADJUSTABLE MAGNIFICATION

REDUCES AIR GAGE COSTS



PICK YOUR DIAL

- ① 27 STOCK DIALS ON TWO STANDARD MODEL AIR GAGES COVER MAGNIFICATION FROM 35X TO 4,000X OR 2,000X TO 28,000X.
- ① THE GAGE FITS THE JOB. NO COMPROMISE.
- ① CLIP ON DIALS AND EASY ADJUSTMENT ENABLE GAGING SET-UPS TO BE CHANGED IN MINUTES.
- ① EACH AIR PLUG OR AIR RING COVERS A LARGE RANGE OF TOLERANCES AND ZERO POINTS; MANY EXISTING PLUGS AND RINGS CAN BE USED.
- ① ASK YOUR MAN-FROM-STANDARD FOR AN ON THE JOB DEMONSTRATION.
- ① WRITE TODAY FOR OUR NEW AIR GAGE CATALOG #61 AND SPECIAL REPORT "REDUCE AIR-PLUG COSTS — HOW TO DO IT."



STANDARD GAGE COMPANY, INC.

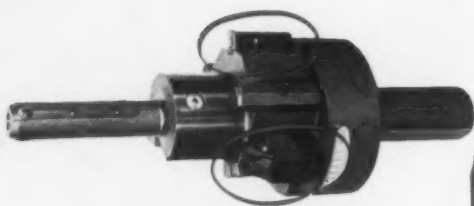
POUGHKEEPSIE, N. Y.

TELEPHONE GROVER 1-3100

WHICH WAY TO BORE...

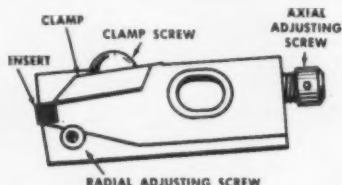
REGRINDABLES or

*guaranteed performance makes
it easier to decide...*



Wesson Development Simplifies Tooling and Reduces Inventory Needs

Only 5 basic cartridges (18 options for rake angle and opposite hand) are required to assemble an unlimited variety of single or combination boring, turning and milling tools. Using throw-away inserts and incorporating both radial and axial adjustment, the cartridge fits in a keyway in the bar body or tool block.



Exclusive advantages not possible with any other form of tooling include:

Minimum Holder-Parts-Insert Inventory
Unlimited Application Flexibility
Lowest Tool Cost; No Grinding
Precision Adjustment

For complete details ask your Wesson man or write for Bulletin C-660.

When Wesson recommends tools for your job, they are guaranteed to perform as specified regardless of which-ever type tool is best for your application (Wesson makes both regrindables and throw-aways). This performance guarantee is possible because:

- 1) Your local Wesson field engineer is an expert in boring, turning and milling with carbides (see examples at right).
- 2) He is prepared to make a thorough, In-Plant Job Analysis of your applications and recommend the best tooling to suit the conditions.
- 3) He follows through to make sure that the tools are installed properly, used properly and perform properly.
- 4) Behind every field man is the extensive experience and facilities of Wesson's 4 specialized tool plants, basic research, application research and tool engineering groups and Wesson's own carbide metals plant.

A Wesson In-Plant Job Analysis—at no cost to you—enables us to make a sound recommendation based on all the facts. Call your Wesson man in—if he can improve your operations he'll give you a detailed description of how—if he can't improve them... he'll tell you that too!

In any case, call him now and ask for your copy of the new 8-page booklet, "How to Bore with Regrindables or Throw-Aways". (Or write us, if you prefer.) This booklet can be of considerable help in planning boring operations.

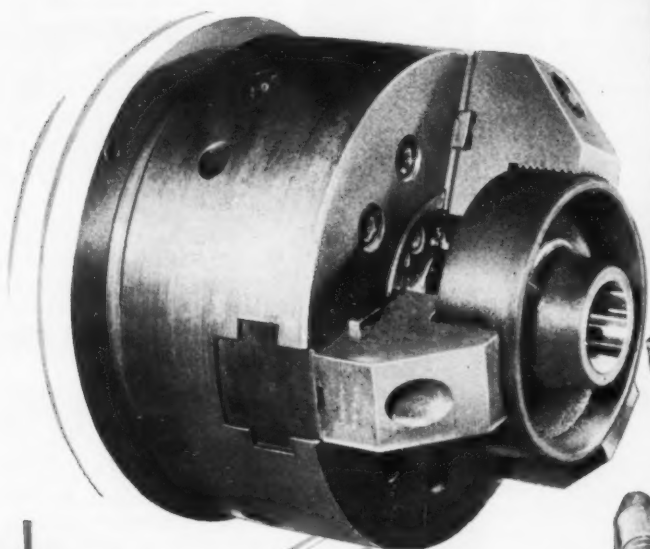
Wesson Company, 1220 Woodward Heights Blvd., Ferndale 20, Michigan. In Canada: Wesson Cutting Tools Ltd., 93 Judge Road, Toronto 18, Ontario.

WESSON

WESSON COMPANY • ARCHER & SMITH

WESSON RESEARCH • WESSON METAL CORP. • WESSON MULTICUT CO. •

THROW-AWAYS?

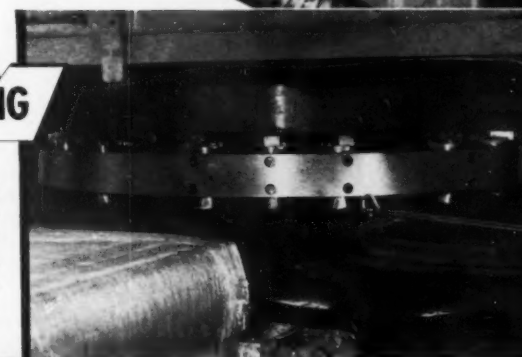


BORING

After failure of all other boring tools tested, this company asked the Wesson field engineer for a job-analysis study. Result: a standard Wesson PAS (positive-rake) boring bar with Wesson-metal WH inserts now bores these hubs at a rate of 160 pieces per insert.

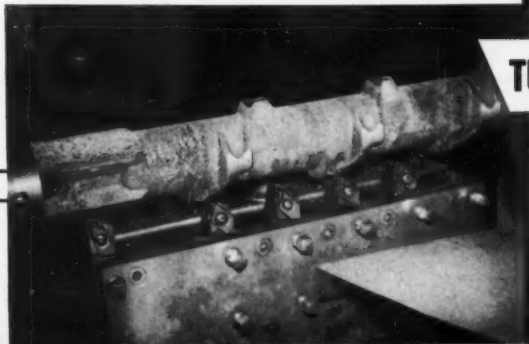
MILLING

Tool life extended from 8-hours to 12-weeks and tool adjustment time reduced from 2-hours to a few minutes . . . that's the Wesson record on this scalping mill. Wessonmetal GI inserts (in locator-anvil units) are micro-adjustable to permit quick setting of face runout.



TURNING

Severely interrupted cuts can impose excessive tool shock loads. A Wesson In-Plant Job-Analysis recommended multiple tools—with successive tools taking identical cuts. Two tool blocks—each with five throw-away insert holders—now turn out 450 pieces per set of inserts.



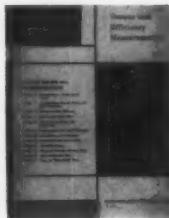
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Fasteners and Corrosion Resistance

H. M. Harper Co., Morton Grove, Ill. Pamphlet discussing various kinds of corrosion and the different metals suited to resist them. Included are a guide chart listing thirty-six types of corrosive agents and a chart for specifying metal fasteners.

Circle Item 535 on Inquiry Card



Torque-Measuring Instruments

Power Instruments, Inc., Skokie, Ill. Brochure illustrating how to measure the torque characteristics and speed of motors, gear trains, servomechanisms, and potentiometers. Torque ranges from 1/4 gram-centimeter to 200 pound-inches are covered.

Circle Item 541 on Inquiry Card



Speed Indexer

Erickson Tool Co., Solon, Ohio. Bulletin presenting specifications and engineering data on Erickson speed-indexer Models 400, 450, and 600, which use pneumatic or hydraulic power to index rapidly (manually or automatically) and accurately.

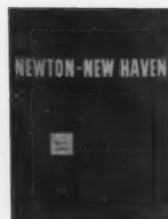
Circle Item 536 on Inquiry Card



Cap-Screws

Klincher Kapscrew, Inc., Indianapolis, Ind. Brochure on the self-locking Kapscrew, its design and principle of locking. The Kapscrews resist ultrasonic vibration, will withstand temperatures to 1600 degrees F., and are re-useable indefinitely.

Circle Item 542 on Inquiry Card



Die Castings

Newton-New Haven Co., West Haven, Conn. Catalogue providing information on the company's facilities for the design and production of aluminum and zinc die castings. The people involved, the plants, and the machinery are described and illustrated.

Circle Item 537 on Inquiry Card



Servo Valves

Moog Servocontrols, Inc., East Aurora, N. Y. Bulletin 110 giving information on servo valves and potential applications of electrohydraulic control systems. Design data on single-stage, two-stage, flow-control, and pressure-control servo valves are given.

Circle Item 543 on Inquiry Card



Bolts

Standard Pressed Steel Co., Jenkintown, Pa. Brochure (Form 2717) covering the EWB 1218 external-wrenching bolt, which is claimed to have higher bolting strength for temperature applications up to 1200 degrees F. Dimensional specifications are given.

Circle Item 538 on Inquiry Card



Silver-Brazing Alloys

Air Reduction Sales Co., a division of Air Reduction Co., Inc., New York City. Revised catalogue 925 (Form ADC 847C) discussing brazing procedures for Aircosil silver-brazing alloys—from those in standard rod form to the new Aircosil Fluxcor 45.

Circle Item 544 on Inquiry Card



Die-Heads

Eastern Machine Screw Corporation, New Haven, Conn. Bulletin No. 12D containing details on H&G stationary die-heads, Styles DMS self-opening and DMSL with alignment feature. Also included is a description of H&G throw-away insert chasers.

Circle Item 539 on Inquiry Card



Press-Brake Dies

Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 92 featuring the company's Tufloy line of standard, stocked press-brake dies. Described are 90- and 30-degree air bend dies, flattening and offset dies, three- and four-way dies; etc.

Circle Item 545 on Inquiry Card



High-Frequency Tools

Thor Power Tool Co., Aurora, Ill. Catalogue No. 62 giving details on the company's complete line of high-frequency electric tools, including grinders, sanders, polishers, impact wrenches, screwdrivers, nutsetters, drills, reamers, and balancers.

Circle Item 540 on Inquiry Card



Carbide Dies

Oberg Mfg. Co., Inc., Freeport, Pa. Bulletin 261 containing descriptions of numerous carbide dies—progressive rotor-stator, full-pierce rotor-stator, and synchro-motor models; progressive E & I and ballast types; thick-material dies; etc.

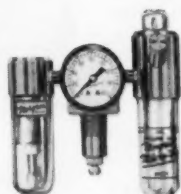
Circle Item 546 on Inquiry Card

Norgren Lubro-Control Units

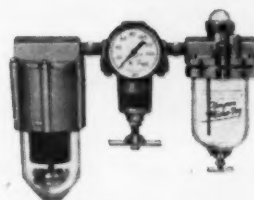
A complete line of **visible oil feed** lubricator units for air-tools, air cylinders and other air-powered equipment

NORGREN Micro-Fog Combination Units

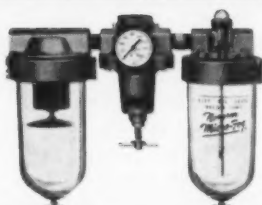
Easily adjustable for the exact amount of lubrication required



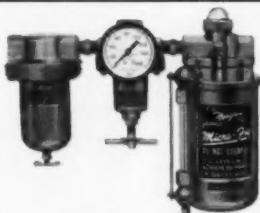
Transparent bowl filter; pressure regulator with gauge; transparent bowl Micro-Fog Lubricator. $\frac{1}{8}$ " pipe size. $\frac{1}{2}$ oz. lubricator capacity. Small, compact unit for use where space is tight.



Transparent bowl automatic-drain filter; regulator with gauge; transparent bowl, Micro-Fog Lubricator. $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1" pipe sizes. $\frac{1}{2}$ pt. lubricator capacity.



Transparent bowl manual-drain filter; pressure regulator with gauge; transparent bowl, Micro-Fog Lubricator. $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1" pipe sizes. 2 $\frac{1}{2}$ pts. lubricator capacity.



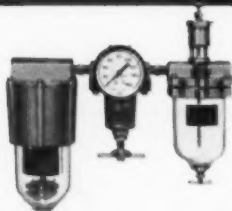
Replaceable metal bowl manual-drain filter; pressure regulator with gauge; replaceable metal bowl, Micro-Fog Lubricator with constant oil level. $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1" pipe sizes. 1 qt. lubricator capacity.



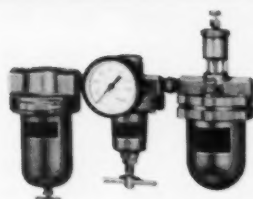
Compact cabinet unit for air operated machine tool applications. Provides filtered air, accurate regulation and control of oil delivery, visible, adjustable oil feed. $\frac{1}{2}$ " pipe size. 10 oz. oil capacity.

NORGREN Oil-Fog Combination Units

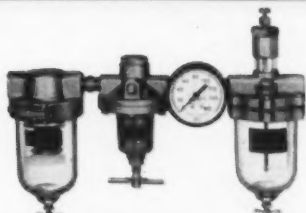
Efficient, effective lubrication of air-powered equipment.



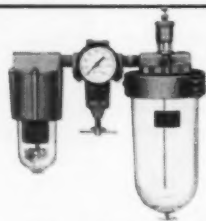
Transparent bowl automatic-drain filter; regulator with gauge; transparent bowl lubricator. $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1" pipe sizes. $\frac{1}{2}$ pt. lubricator capacity.



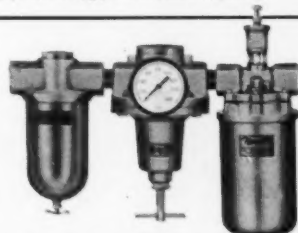
Replaceable metal bowl manual-drain filter; pressure regulator with gauge; replaceable metal bowl lubricator. $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1" pipe sizes. $\frac{1}{2}$ pt. lubricator capacity.



Transparent bowl manual-drain filter; pressure regulator with gauge on tee; transparent bowl lubricator. $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1" pipe sizes. $\frac{1}{2}$ pt. lubricator capacity.



Transparent bowl automatic-drain filter; pressure regulator with gauge; transparent bowl lubricator. $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1" pipe sizes. 1 $\frac{1}{2}$ qt. lubricator capacity.



Metal bowl manual-drain filter; pressure regulator with gauge; replaceable, metal bowl lubricator. $\frac{1}{4}$ ", 1" pipe sizes. 1 qt. lubricator capacity.

Shown here are a few models from Norgren's complete line of air filters, pressure regulators and lubricator units. For full information, call your nearby Norgren representative listed in your phone directory, or write for descriptive literature.

C. A. NORGREN CO.

3419 SOUTH ELATI STREET • ENGLEWOOD, COLORADO

• Yours for the asking . . . use postcard inside back cover



Crown-Gear Grinder

Michigan Tool Co., Detroit, Mich. Data sheet on the Model CGG-16x18FA automatic crown-gear grinder. Details are given on various cycles of rough, semifinish, and finish grinding; rates of feed; wheel dressing; compensation for wheel wear; etc.

Circle Item 547 on Inquiry Card



Blast-Cleaning Machines

Pangborn Corporation, Hagerstown, Md. Revised Bulletin No. 704A giving a description of Rotoblast barrels. Featured are case histories and photos of Rotoblast installations where brake-shoes, clutches, generators, and other parts are refinished.

Circle Item 548 on Inquiry Card



Electronic Gaging Equipment

Airborne Instruments Laboratory, a division of Cutler-Hammer, Inc., Deer Park, N. Y. Bulletin describing MICRO-trol electronic gaging and automatic control equipment. Gage heads, mechanical and electrical accessories, etc., are discussed.

Circle Item 549 on Inquiry Card



Precision Switches

Micro Switch, a division of Minneapolis-Honeywell Regulator Co., Freeport, Ill. Catalogue 104 covering products from the Micro Switch line of precision switches for industrial, commercial, data-processing, airborne, and electronic applications.

Circle Item 550 on Inquiry Card



Electronic Gage

Taft-Peirce Mfg. Co., Woonsocket, R. I. Catalogue No. 614 on the Versachek electronic gage for applications in production, inspection, or quality-control departments. Three-light and multiple-stage classifiers, differential gaging, etc., are described.

Circle Item 551 on Inquiry Card



Electronic Assemblies

AMP Inc., Harrisburg, Pa. Booklet on a concept in three-dimensional modular packaging and interconnecting of electronic components. Two AMP-Meca (maintainable electronic component assemblies) kits for prototype designing are illustrated.

Circle Item 552 on Inquiry Card



Jig and Fixture Clamps

Morton Machine Works, division of Brubaker Tool Corporation, Millersburg, Pa. Catalogue No. 6 giving information on the firm's jig and fixture clamps and components. Clamp straps, cams, bolts, handles, knobs, nuts, pads, etc., are included.

Circle Item 553 on Inquiry Card



Clutches

V-Belt Clutch Co., Los Angeles, Calif. Catalogue 40 presenting the firm's line of standard, custom, and advance-design lever-action clutches. The patented Ball-Lok clutch is said to give safe, automotive type, smooth start and stop clutching.

Circle Item 554 on Inquiry Card



Chuck and Collet Actuators

Power Grip, Inc., Rockfall, Conn. Folder No. 30261 covering the firm's chuck and collet actuators. They are available in five different sizes—Models 2D, 4A, 5B, 6A, and 7A—with capacities to operate power chucks from 4 1/2 to 15 inches in diameter.

Circle Item 555 on Inquiry Card



Lock-Nuts

Elastic Stop Nut Corporation of America, Union, N. J. Design Manual No. 6101 including twelve tables listing recommended installation torque values for thin and standard-height UNC and UNF hex type "Elastic Stop" nuts. Tables on tensile stress are included.

Circle Item 556 on Inquiry Card



Hydraulic Press Brakes

National Automatic Tool Co., Richmond, Ind. Bulletin No. 400 containing details on Natco hydraulic press brakes. Five models of 200- to 500-ton capacity cover a wide range of fabricating operations. Illustrations and specifications are included.

Circle Item 557 on Inquiry Card



Pressure-Forming Machine

Producto Machine Co., Bridgeport, Conn. Bulletin featuring the Model P-88 laboratory pressure-forming machine. Push-button control is quick and simple, and heat and pressure systems make it ideal for product sampling and development work.

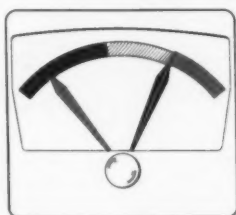
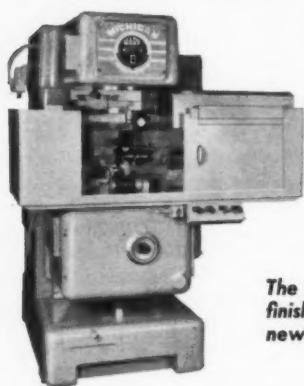
Circle Item 558 on Inquiry Card



SOLUTIONS TO GEAR PROBLEMS

WANTED: AUTOMATIC WARNING WHEN SHAVING CUTTERS ARE DULL

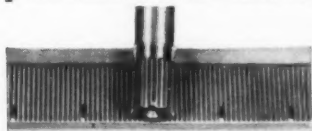
This has been solved in the new Mark II gear finisher. An indicator connected to the cutter drive circuit registers power required to drive the cutter, warns when preset 'dullness' is reached. Device also protects against cutter breakage by dropping the machine knee or warning if an oversize gear should be loaded into the machine. Ask for Bulletin 870-60.



The Mark II gear finisher is full of new features

WANTED: A SIMPLER WAY TO PRODUCE SPLINES 'FOOLPROOF' IN ASSEMBLY

Such splines can be produced without additional operations or time on Roto-Flo machines. A fool-proof double-width index-locating spline tooth is created simply by grinding off one end of the forming rack teeth at the locating point. Incidentally, the Roto-Flo produces such a spline in just a few seconds. Ask for Bulletin RF-60.



A Roto-Flo produces splines, threads, grooves, in one pass

WANTED: A WAY TO GET RID OF SETUP AND 'FEEL' ERRORS IN INVOLUTE CHECKING

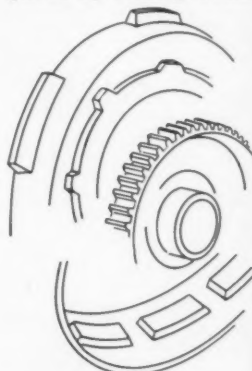
To answer this, we now have available an optical attachment for setting the sine-bar on ANY Michigan Tool #1124 involute checker. Remarkably fast and provides greater setup consistency for increased accuracy. Ask for Bulletin 1124-60.



Fast optical sine-bar setting on an 1124 involute checker

WANTED: A SINGLE PROCESS FOR CUTTING ALL KINDS OF INTERRUPTED TOOTH FORMS IN DIFFERENT MATERIALS

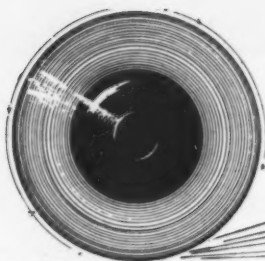
We already had the answer to that: the Shear-Speed gear shaper. This machine will cut practically any peripheral shape—spur involute and straight teeth, interrupted or not, cam forms, ratchets, etc., in steel, cast iron, aluminum, and even plastics—in a small fraction of the time required by other processes. Ask for Bulletin 3000-60.



(above) A few of the many shapes produced in one plant by the Shear-Speed



MICHIGAN TOOL COMPANY, 7171 E. McNICHOLS RD., DETROIT 12, MICHIGAN



By E. S. Salichs

BETWEEN GRINDS

Free Fuel to Fire Farmers

Buyers of Ford Diesel tractors from January through March were receiving from their dealers one-half the cost of their fuel purchases for the first 400 hours, or six months, of tractor use—whichever occurs first. This share-the-operating-cost plan was developed to stir farmers into buying their tractors earlier than they are accustomed to doing. With Christmas shopping practically being moved up to July, we see no reason why farmers should object to tractors in January.

Watch Your Dust?

A new Royco particle counter will count the number of particles present in the atmosphere, the maximum count rate per minute without exces-

sive coincidence loss being 7340 particles, and no minimum. That is to say, no particles, no response by the instrument. It is intended for areas devoted to precision manufacture and assembly; and don't, in a spirit of fun, bring it home.

An Out-of-This-World Vacation

How to get wherever in space you want to go will be easy after Alfred Block and his associates, Lockheed scientists, complete their work on an automatic timetable system for charting flight paths in space for low-thrust rockets. Just consult your travel agent. These rockets can operate continuously, in some cases for a year or longer. Under these long-firing times, according to Mr. Block, they can build up to tremendous

speeds. It is like holding down the accelerator for a year on a car with frictionless engine and wheel bearings. And, Junior, no cops—for a while, anyway!

Sky Living

An octagonal house has been built in the hills of Hollywood perched atop a 30-foot concrete column. It is called the Chemosphere house, having utilized many specially developed synthetic rubber and superadhesive materials in its construction. The structure was built on the column for a definite purpose—to provide a footing stable enough to withstand earthquakes, landslides, high winds, and other disturbances of nature and man, like the borrowing neighbor. We are trying to figure out how much our real-estate taxes would be on just enough land to set a pole in.



MR. SWASEY, SPACEMASTER—Standing next to the dividing engine he designed is Ambrose Swasey (of the Warner & Swasey Co., Cleveland, Ohio) in the Year 1896. Little did he know then that it would be used today to meet a difficult challenge in the field of space-age metalworking. The dividing engine handled the scribing of a master encoder disc for the electronic system of one of industry's newest numerically controlled turret lathes, which will soon be used for machining critical contoured components for missiles and aircraft. The master encoder disc made on the machine measured about 39 inches in diameter and had to be divided into 2048 separate equal divisions. A dilly to divvy!

WHITMAN & BARNES
MAKERS OF FINE DRILLS SINCE 1848
DRILLS AND REAMERS



which drill really costs less?

Based on results, drills "A" and "B" (center and right, above) should cost 43% and 39% less than W & B drills (left, above)—instead, they can be purchased at *only* about 20% less.

Watch those *initial* costs—they may be costly!

COMPARATIVE DRILLING PERFORMANCE

General Purpose Jobbers Drills	*No. of holes per drill size					Total No. of Holes	Efficiency Rating
	#40	#30	3/16"	1/4"	5/16"		
W & B Drills	208	62	57	50	34	411	100%
"A" Drills	142	24	14	28	28	236	57%
"B" Drills	114	49	13	61	15	252	61%
Thickness of plate	3/16"	3/16"	1/2"	1"	1"	Material: Heat treated chrome nickel steel	

*In each drill size, five drills of each brand were tested and each drill was resharpened three times as required.



PARTNERS IN PRODUCTION PROGRESS

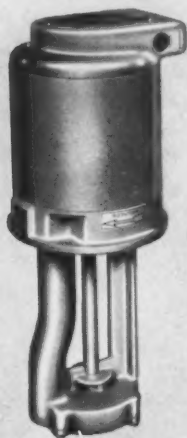
Many drill performance tests similar to this one have been made. However, W & B will gladly conduct drill tests at *your* plant and under *your* conditions. Contact us direct or through your W & B distributor. He can offer this service plus fast delivery from complete stocks.

WHITMAN & BARNES

40000 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN

DRILLS • REAMERS • END MILLS • COUNTERBORES • COUNTERSINKS • CARBIDE TOOLS • SPECIAL TOOLS

Always
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in their field . . .



Gusher COOLANT PUMPS

The original motor driven centrifugal machine tool coolant pumps.

First precision made dynamically balanced coolant pumps — comparable in workmanship to the machine tools they serve.

First ball-bearing pre-lubricated coolant pumps requiring no seals . . . no priming . . . minimum maintenance.

First with split-second coolant flow from the moment that the machine is turned on.

Follow the leading machine tool builders . . . specify Gusher Coolant Pumps on your machines.

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MACHINERY CO.

1807 Reading Rd.
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(New Developments in Shop Equipment—Continued from page 182)



Flexowriter developed to insure accuracy of tape for numerical-control systems

Flexowriter Tape Verifier for Numerical Control

To insure the accuracy of input coding for point-to-point or continuous-path machine tool controls, including any intermediate computer functions, Friden, Inc., San Leandro, Calif., now offers a Flexowriter with motorized tape reader to prepare and verify codes punched in eight-channel tape. The Flexowriter, an automatic writing machine, is currently used to code-punch tapes for controlling all types of metal-removing machinery, such as drill and punch presses, milling machines, shapers, and lathes. Some of the most recent applications of Flexowriter-prepared tapes are for spot welding and forming machines, and rolling mills. Now, with the motorized tape-reader hookup, programmed control codes can be quickly compared to minimize the possibility of human error.

As a proof document is being typed on the Flexowriter, a by-product tape is punched simultaneously. This tape is then inserted in a Friden motorized tape reader which is cable-connected to the Flexowriter. The document is then retyped. As each character is keyboarded, its assigned code is compared with the original code being read in the motorized unit. If the two codes match, the Flexowriter will punch the verified code in a new tape. If the codes do not compare, the Flexowriter punch will not perform. The keyboard will lock.

To determine where an error

has occurred, the operator checks the visible proof of the second typing or the original tape in the motorized reader. Then, by touching the "Error Reset" switch on the front panel of the Flexowriter, the keyboard will unlock. The correct character is typed and its code equivalent is punched in the second, or verified, tape. This motorized tape reader is designed to keep pace with the fastest typist.

As an extra feature, the Flexowriter contains a device on its punch to check for odd bits (holes) that make up each code. If the codes all contain an odd number of bits, for example, and some punching malfunction produces an even-bit code in the tape, the Flexowriter keyboard will lock and an indicating light will glow. The operator must press the error switch to unlock the keyboard and turn a tape-feed knob back one notch to align the incorrect code in the punch. By simply touching a "deletion" key on the Flexowriter, typing and punching can be resumed.

The Flexowriter uses a 1-inch wide paper tape. Code holes are numbered 8-7-6-5-4-3-2-1 from left to right facing the leading edge of the tape. Feed holes are punched between the 4 and 8 code holes, 0.394 inch from the right edge of the tape in line with the code holes. Ten codes are punched in each inch of tape.

Circle 624 on Readers' Service Card

Recorder-Controller for Protective Atmospheres

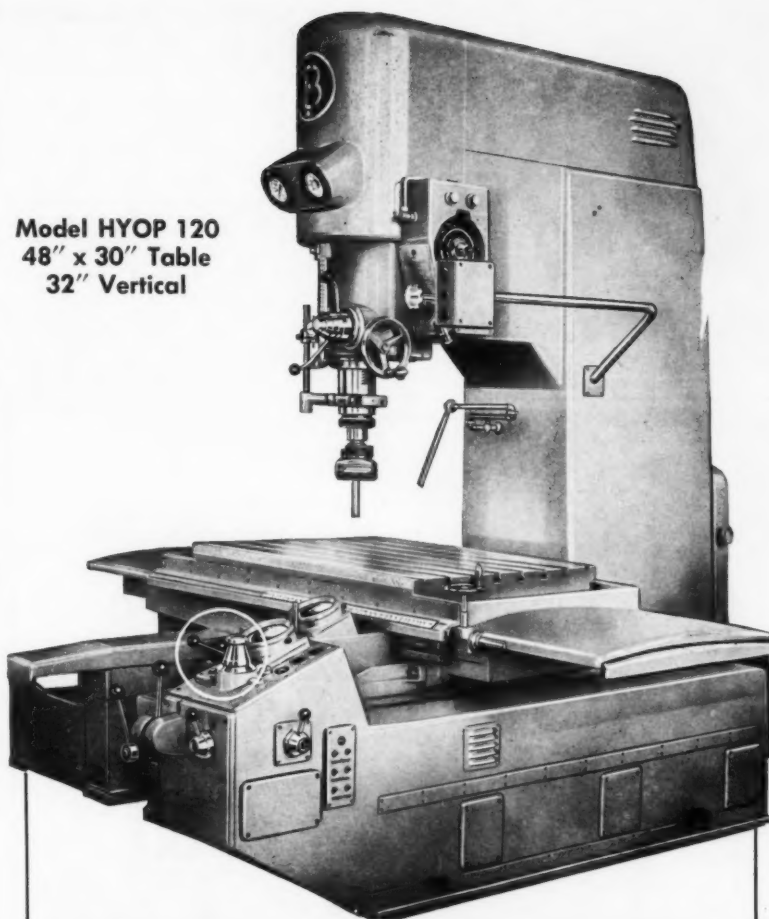
The Industrial Instruments Division, Barber-Colman Co., Rockford, Ill., has announced the addition of a new instrument to their expanding line of control equipment. The new unit is identified as a Model 30D recorder and controller which automatically records and controls the dew point of the protective gas atmosphere used in heat-treating, brazing, and sintering operations. Since the dew point has a definite relationship to the other gaseous constituents, the oxidation and carbon potentials of the sampled atmospheres are capable of being controlled. The sensing unit of this instrument is a relative humidity device which can be calibrated in degrees Fahrenheit dew point. The sensing arrangement has many advantages, including: the elimination of the condensation and evaporation of the water vapor and its extraneous contaminants of the gas sample, elimination of the refrigeration unit and its attendant maintenance problems, and operation with only a water line when the instrument is functioning over its usual range of -10 to +70 degrees F. dew point. Low maintenance cost is also an important advantage.

Circle 625 on Readers' Service Card



Barber-Colman recorder-controller for protective gas atmosphere

Model HYOP 120
48" x 30" Table
32" Vertical



BURKHARDT OPTICAL JIG-BORER

—The most modern design—

- Single Lever Control
- No Gears, No Leadscrews
- All Movements inf. Variable
- 5" Quill — 8 HP Motor
- LEITZ Optics 0.00005"

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Midwest's Leading Importer of German & Swiss Prec. Machine Tools

STOCK DELIVERIES

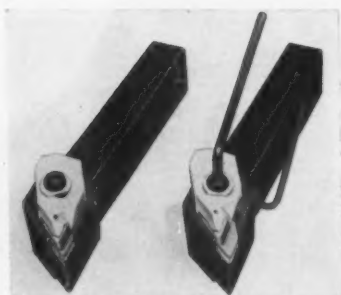


Fig. 1. Two views of tracer type Carboloy Adjust-O-Breaker tool-holder, showing extremes of breaker position adjustment

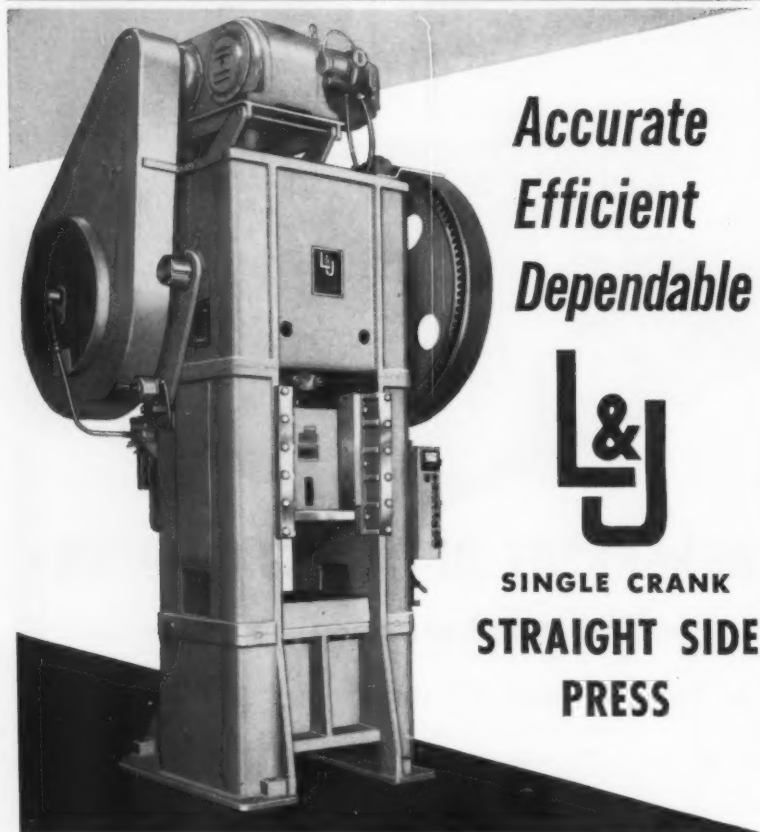
G-E Tracer Type Adjust-O-Breaker Tool-Holders

The Metallurgical Products Department, General Electric Co., Detroit, Mich., has announced two styles and seven sizes of negative-rake, tracer type Adjust-O-Breaker tool-holders. In addition, twenty-four new sizes of negative-rake Adjust-O-Breaker holders, making a total of fifty-four, and five new styles and fifty sizes of positive-rake Adjust-O-Breaker holders are now available. The Adjust-O-Breaker is now made for all types of short- and medium-run work

and job-shop production. This versatile, disposable-insert tooling with quick chip-breaker adjustment, which can be made on the machine, makes possible substantial time savings.

Fig. 1 shows two views of a typical Adjust-O-Breaker tracer type holder, illustrating range of adjustment. Change in breaker position is made by loosening the clamp screw (top) and turning the adjusting screw (side). This side-adjusting screw has a wrench socket at each end, so that the adjustment may be made from either side of the tool.

The clamp, which holds both the chip-breaker and the insert, is of strong bridge type design which bears on the breaker at one end and on the tool body on the other. The clamping force exerted entirely on the flat of the breaker and insert resists pull-out of the insert.



**Accurate
Efficient
Dependable**

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**SINGLE CRANK
STRAIGHT SIDE
PRESS**

STANDARD EQUIPMENT

Air clutch and brake. JIC controls plus dual air valve. Four square type gibs with bronze surfaced ways on ram. Hard bronze crankshaft bushings and ball seat. Ram counterbalances. Forced lubrication, etc.

- 150 ton capacity adaptable for a wide range of jobs.
- Plain flywheel or back geared type.
- 6½" dia. main bearings, 9" dia. crank pin.
- Dimensions of bed and ram face, stroke length and shut height available as required.
- Extra heavy box type steel weldment tie rod construction.
- Rigid and accurate for precision work and long die life.



Write — Bulletin L-18 on 20 to 150 ton single and double crank straight side presses . . . also, 30 to 75 ton double crank gap frame presses.

L&J PRESS CORPORATION

1631 STERLING AVE.
ELKHART, IND.

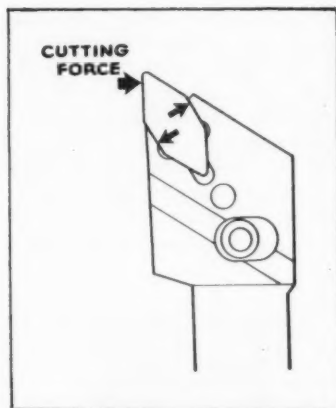


Fig. 2. Diagram of Adjust-O-Breaker tool-holder, showing elongated diamond-shape carbide insert

The diagram of the Adjust-O-Breaker tracer holder, Fig. 2, illustrates the elongated diamond-carbide insert. Use of this longer diamond insert with a flat on each side permits a much stronger design. The elongated diamond shape enables the insert to be so held that it cannot rotate or twist out of the holder when the cutting load is applied. The two ends of the Carboloy cemented tungsten-carbide insert are identical, which permits indexing to a sharp point

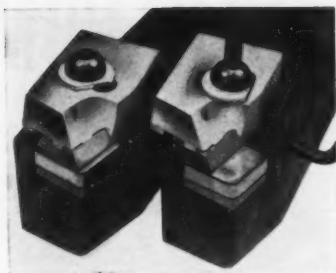


Fig. 3. Regular type Adjust-O-Breaker tool-holders, showing extremes of breaker adjustment

when the first point becomes dull. A negative-rake insert makes available four usable edges.

Fig. 3 shows two Adjust-O-Breaker tool-holders with the chip-breakers in extreme positions to illustrate adjustment range.

Circle 626 on Readers' Service Card

Sheet-Metal Shear

An all-in-one shear with its own power unit has been introduced by C. W. Lind Co., Minneapolis, Minn. New design and construction features that add to its ruggedness are said to have been incorporated in this model. Several of the popular brand 1/4-inch industrial drills can be used as an alternate power source. This is a versatile tool that permits fast, clean cuts on sheet metals up to 18-gage mild steel, and up to 1/16-inch laminated plastics. Its powerful scissor action makes small radial cuts possible in light materials. Square, rectangular holes or straight cuts can be made quickly and easily from a 1/4-inch starting hole.

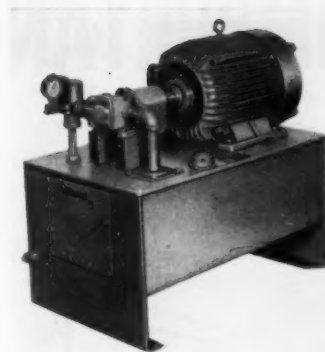
Circle 627 on Readers' Service Card



"Docken" sheet-metal shear

Single-Pump Hydraulic Power Units

A new line of versatile 1000- and 2000-psi single-pump hydraulic power units with a working-capacity conversion feature has been announced by Hannifin Co., Des Plaines, Ill., a division of Parker-Hannifin Corporation. To meet possible increased power requirements after purchase, eleven of thirteen Hannifin "VSP" hydraulic power units may be converted to 2000-psi units by in-



Hannifin hydraulic power unit

NEW

HAMILTON VARIMATIC® PRECISION DRILLING MACHINE



SUPER SENSITIVE
CAPACITY TO 5/16"

Brings a new dimension to the production drilling of small precision holes. Drills to the center of a 10" circle. Head swings radially on column and locks at any position. 6" vertical adjustment of head on column. 2 1/2" feed, idle. Speeds from 840 ft. .00 R.P.M. infinitely variable in two ranges.

If you would like the complete Varimatic story . . . with pictures, and a sectional engineering drawing . . . write for our FREE Bulletin No. V/2961.

It's a
2961
HAMILTON
TOOL

use it with confidence!

THE HAMILTON TOOL COMPANY

834 SOUTH NINTH STREET

HAMILTON, OHIO

IMPORTANT POWER HYDRAULIC PUMP

QUIET OPERATION



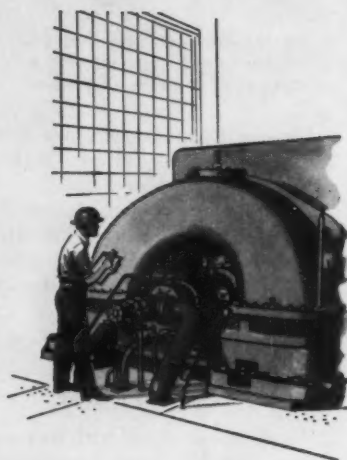
The smooth rolling action of the DeLaval IMO® pump eliminates noise, vibration, and hydraulic whine. There are no reciprocating parts to wear and become noisy. "Hospital quiet" is assured. This is why the noise-conscious elevator industry has virtually standardized on the IMO pump for hydraulic passenger elevator installations. For the same reason, the Navy uses IMO pumps for practically every submarine hydraulic service.

RELIABLE OPERATION

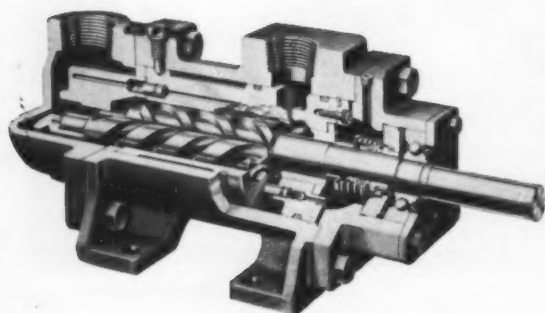


IMO pumps require no timing gears, cams, valves, sliding vanes or reciprocating parts. There is nothing to get out of order, nothing to adjust. IMO pumps for lube oil and fuel oil service are on almost all U. S. Navy combat vessels. They demonstrated their reliability so completely during World War II that the Navy removed IMO pump spare parts from many vessels to allow extra ammunition to be carried.

HIGH SPEED



Only the IMO pump has proved acceptable for integral mounting on high-speed machinery, such as turbine governor controls. Standard types have given dependable, quiet operation at speeds up to 12,000 rpm. Special types have been built for operation at 24,000 rpm pulling a lift. For many applications at 1750 and 3500 rpm motor speeds, the IMO pump means lower-cost drives.



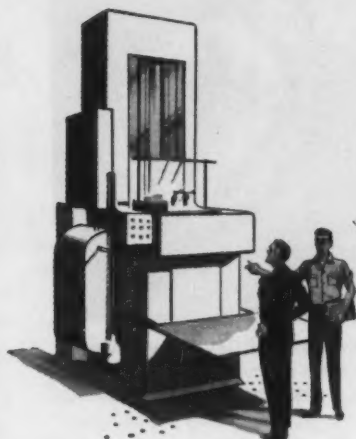
How the IMO Pump works

The DeLaval IMO pump is a constant-displacement, rotary, screw-type pump. Fluid is propelled axially in a constant, uniform flow through the action of just three moving parts — a power rotor and two idler rotors. The power rotor is the only driven element, its end being extended outside the pump casing for direct connection to the power source. Idler rotors are turned by the action of the fluid pumped and act as sealing elements, their accurately machined threads conforming perfectly to the threads of the power rotor and the surfaces of the housing cylinder.

Since the idler rotors perform no work; the IMO pump screws need not be connected by gears to transmit power between screws. The sealed closures formed by the meshing of the rotors inside the

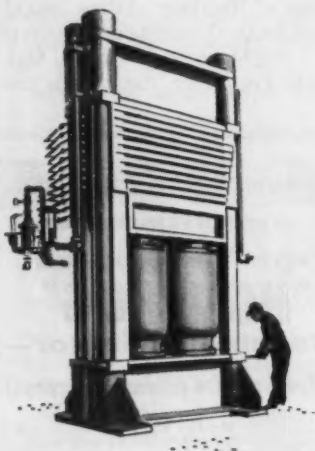
CHARACTERISTICS - Which are vital to you?

NON-PULSATING FLOW



Fluid delivery is continuous, resulting in pulsation-free flow. There are no intermittent strokes, no churning. In many broaching operations pump pulsation can adversely affect the finish which is of utmost importance. A non-pulsating IMO pump is ideally suited to such applications.

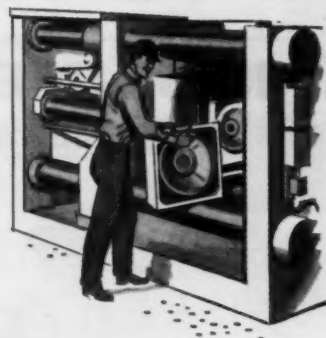
HIGH CAPACITY



A single IMO pump can deliver up to
3000 gpm at 300 psi
1000 gpm at 500 psi
400 gpm at 3000 psi

Because of its wide range of capacities and pressures, the IMO pump is widely used in hydraulic press applications which, as a rule, require high capacities at low to medium pressures for pre-fill service, then low capacity at high pressure during the working part of the stroke.

FIRE-RESISTANT FLUIDS



The IMO pump has been applied widely on phosphate ester and water glycol fire-resistant fluids. Although rotary pumps in general have not performed too well when handling water glycols, the standard IMO pump has been applied with excellent results. To apply the IMO pump on phosphate ester fluids, it is necessary only to change seal and "O" ring materials.

housing enfold the fluid being pumped. As the rotors turn, these enclosures move axially providing a continuous, uniform flow much like that of a piston moving continuously in one direction. The rolling action obtained with the IMO pump screw thread design is responsible for its natural, smooth pumping action and results in exceptionally quiet operation.

For application data, selection information, complete performance on each IMO pump model, dimension drawings and tables, write for Bulletin 3200.



DE LAVAL

STEAM TURBINE COMPANY

919 NOTTINGHAM WAY, TRENTON 2, NEW JERSEY

stalling a motor of additional horsepower.

Thirteen models are offered with reservoir capacities from 15 to 60 gallons and pump capacities to 35 gallons per minute. All standard units are equipped with a separate relief valve and incorporate an 1800-rpm motor. Single-pump power units are ideal in hydraulic applications requiring maximum service and a minimum of maintenance.

Circle 628 on Readers' Service Card

The hardest grades of disposable carbide cutting inserts, those which provide much longer wear resistance in cutting operations yet cannot be brazed normally due to danger of cracking, now can be handled by the latest cutting-tool holding system developed by the Microbore Division of DeVlieg Machine Co., Royal Oak, Mich. For a user, the system pro-



Two styles of DeVlieg Microbore Division's cutting-tool holding system for carbide inserts

vides increased machine tool output, or less cost per piece. It allows accurate, rapid indexing of the cutting edges without removing the insert from the machine.

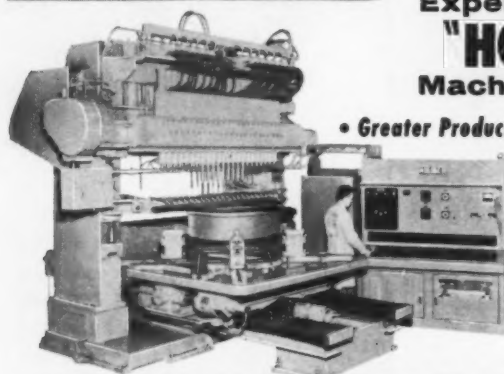
The system is designed to handle a full range of extremely hard carbide or ceramic cutting inserts which can be thrown away when worn. Cutting edges are adjusted in seconds to precise limits by the Microbore micrometer-vernier principle built into the cartridge, which also accommodates an assembly to provide necessary rigidity for heavy cuts.

Two styles are produced by the company. One (Type S), in which a button head screw seats and holds the insert and shim assembly accurately and firmly, is shown in the foreground of the illustration. The other (Type C), in which a clamp-on arrangement is used to release the shim, chip-breaker, and insert for fast indexing, is shown at the rear. The Type S holder is for general-purpose precision boring operations in the smaller hole sizes down to and including 15/16-inch diameter. The Type C holder is particularly well-suited for large bore sizes (Nos. 10, 15, and 20) for light, medium, and heavy cuts. Both styles are made for either angular or straight mounting.

Circle 629 on Readers' Service Card

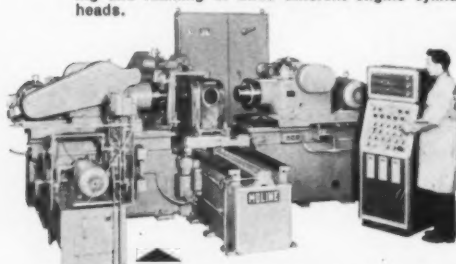
(AS APPLIED TO MULTIPLE SPINDLE DRILLING)

• Greater Production • Efficiency • Savings!



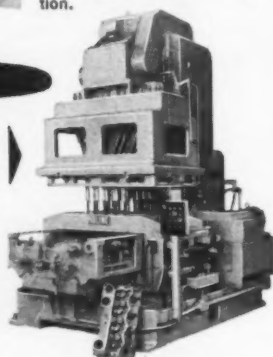
Model HD68 Tube Sheet Drilling Machine with Multi-Numeric Numerical Control for positioning of machine table in two directions and for selection of spindles. Information on punched tape permits automatic drilling of a complete hole pattern in a tube sheet without interruption.

Model HU111 Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 50" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in slip spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder heads.



Model MR148 Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.

HD13 straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.



60 years of Machine Tool Engineering Experience is at your service for

- Multi-Spindle Boring • Single and Multi-Spindle Honing
- Straight Line Multi-Drilling • Adjustable Spindle Drilling
- Special Multiple Operation Machine Tools

Write for Details

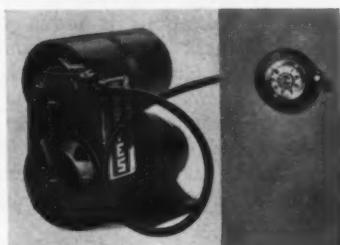


MOLINE TOOL COMPANY

186 20th STREET • MOLINE, ILLINOIS

Representatives
in principal cities

Remote Control for Reeves Motodrive



Remote-control unit and dial

A mechanical remote control for changing output speeds on variable-speed Motodrives has been developed by the Reeves Pulley Division of Reliance Electric & Engineering Co., Cleveland, Ohio. This remote-control unit consists of a flexible shaft and an indicator handwheel which is turned to change speeds. A dial on the face of the handwheel indicates the speed setting. The handwheel is designed for panel or wall mounting, and a mounting bracket is available for machine or free-standing mounting. The flexible shaft, which connects the handwheel to the Motodrive, uses anti-backlash construction, permitting all handwheel movements to be transmitted without absorption by the shaft. The standard shaft is 5 feet long, but other lengths can be specified. The control is available for use on Motodrives rated from 1/4 through 2 hp.

Circle 630 on Readers' Service Card

Buckeye Finishing Tools

An offset pistol-grip handle that permits accurate one-hand control over general-duty finishing operations is featured in the 31V and 31S series grinders and sanders made by the Buckeye Tools Corporation, Dayton, Ohio. A removable and adjustable dead handle is furnished with each model for use on difficult jobs. According to the manufacturer, the use of its efficient, nongoverned air motor provides a high power-to-weight ratio in these compact, well-balanced tools. "Quietool" construction causes the tools to operate quietly at all speeds, and a sensitive trigger throttle allows slow tool start-up and gradual speed increases for close-quarter weld cleanup or feathering. The 31V-

140 grinder (top in illustration) has a 3-inch wheel capacity. Exclusive of wheel, this tool is 5 1/2 inches long, weighs 1 7/8 pounds, and its 3/8-24 spindle turns at 18,000 rpm. An adapter for depressed center wheels is standard equipment. The 31S-140 sander (bottom view) has a 3-inch disc capacity, is 6 1/4 inches long, weighs 2 pounds, and operates at 20,000 rpm. A clamping washer and adapter are standard.

Circle 631 on Readers' Service Card



Buckeye 31V and 31S series grinders and sanders

dependable

Logan / 14" LATHES

How is a lathe's dependability measured? One criterion is the lathe's productive life-span. And this life-span is largely determined by the lathe's quality of design and construction. The Logan lathe bed is an example. It withstands the heaviest bending and torsional stresses. A special alloy and thorough seasoning (before and between machining) insure a warp-free bed. Also, the two V-ways and flat ways are precision ground. You can depend on Logan's low operating cost, too. The 14" swing lathes have variable speed drive (40 to 1400 RPM), and are instantly adjustable while work is turning—without shifting belts! You can also depend on the flexibility of Logan lathes. They have a 9" swing over saddle, 14 5/8" swing over bed, and a 1 1/8" collet capacity to permit a wide variety of operations. But, specifications tell the full story. So, write today for complete information.

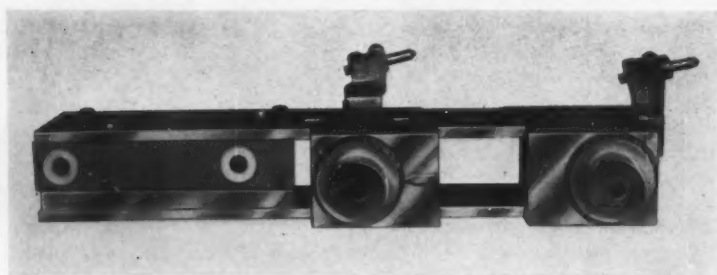


MODEL 6510
\$1,775.00
F.O.B. FACTORY

Logan

LOGAN ENGINEERING CO., DEPT. E-141
4901 W. Lawrence Ave., Chicago 30, Ill.

Sealed Unit in Dresser Arm Compensates for Wear on Diamond Point



Briney wheel-dressing unit with adjusting control over diamond-point wear

INSPECTION PROJECTOR MAGNIFIES FOR [®] QUALITY...

Our inspection projector magnifies cutting edges to eliminate the minute angular deflection that could cause you costly production losses... just one of many inspections that account for Circle R quality.

CIRCLE R saws, slitters and combination center drills must submit to constant exhaustive inspection to work their way to you. They've got to prove they can ensure you correct cutting angles, long service, and minimal downtime.

Consult these CIRCLE R Specialists...

BUFFALO Production Work Sales Inc.	CEDAR RAPIDS Bilham Tool & Supply Corp.	CHICAGO Bussell Robertson & Co.	CLEVELAND Production Tool Co.	DAYTON J. B. Sauer Company	DETROIT J. L. Bradford Associates	HACKENSACK The Karm Company	INDIANAPOLIS Bussell Robertson	MEMPHIS Branch-Morris Tool Specialists	MILWAUKEE Ford Tool Company	MONTREAL Rougemont & Morin	NEW HYDE PARK The Green Company	NEW YORK CITY J. V. Cronin (Export)	PHILADELPHIA General Tool Sales Co.	PHOENIX D'Eagle Tool Center	PITTSBURGH Ralph Spasino & Co.	PROVIDENCE Fred J. Sullivan	ROCHESTER James O. Morris
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CIRCULAR TOOL CO., INC.
PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923

METAL SLITTING SAWS • COPPER SLITTING SAWS • SCREW SLITTING SAWS • COMMUTATOR SLITTING SAWS • JEWELLERS' SLITTING SAWS • CUT OFF SAWS • CIRCULAR DRIVES & ROTARY SHEAR BLADES • CIRCULAR STEEL SAWS • DRILL & TIPPED TWIST-DRILL CARBIDE SAWS • COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS

PROJECTION INSPECTED

CARBIDE COMMUTATOR SLOTTERS

Send for Catalog P Showing More Than 1200 Items

Precision adjusting control over diamond-point wear in grinding, wheel-dressing, and related machining applications is provided by equipment available from Briney Mfg. Co., Pontiac, Mich. The control mechanism incorporates the patented Briney principle that allows adjustments in split-tenths (0.0001 inch and finer) without loosening or tightening any screws.

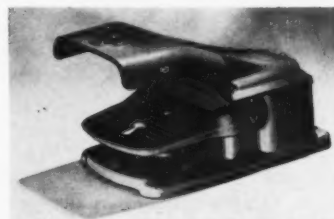
As used in grinding-wheel dressing, the precision adjusting control eliminates tedious and costly hand trial-and-error methods used in making adjustments for diamond-point wear while maintaining the required wheel size. Built into the grinding-wheel dresser arm, the adjusting mechanism is connected directly to the diamond holder. Turning a calibrated knob the required distance adjusts the diamond point.

All units are sealed against coolant and foreign-particle infiltration to eliminate maintenance problems. This same principle of precision adjusting control is also used in boring, turning, and multiple-tooling applications.

Circle 632 on Readers' Service Card

General Electric Foot-Switches

Two new foot-operated switches, ratchet and reverse sequence forms, have been added to the line of cast-iron, snap-action foot-switches manufactured by the General Electric Co., Schenectady, N. Y. These switches are designed for applications requiring foot operation of a machine or process cycle.



Foot-operated switch announced by General Electric Co.

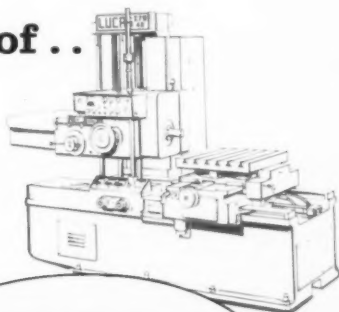
The CR150 A8 ratchet form is designed to meet requirements where maintained control is needed. The contact mechanism consists of a precision snap-action

(Continued on page 209)

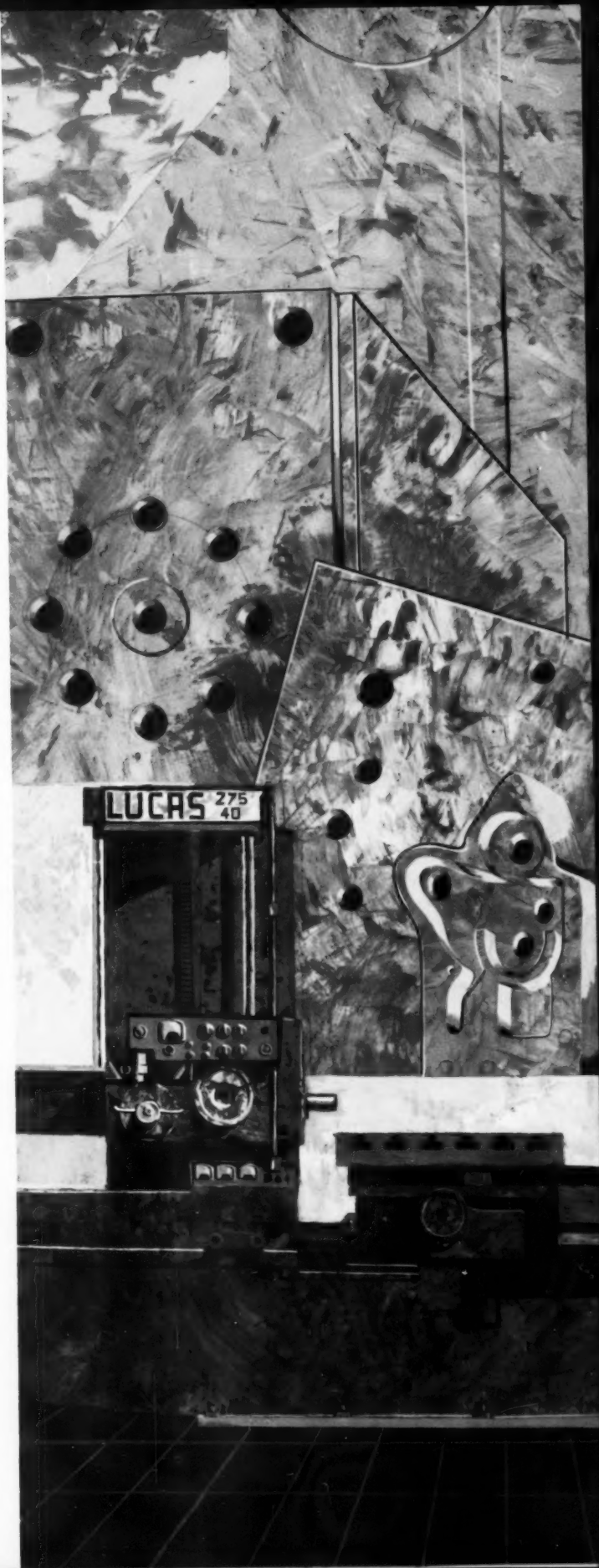
±.0001 accuracy
Versatility unlimited
Small size

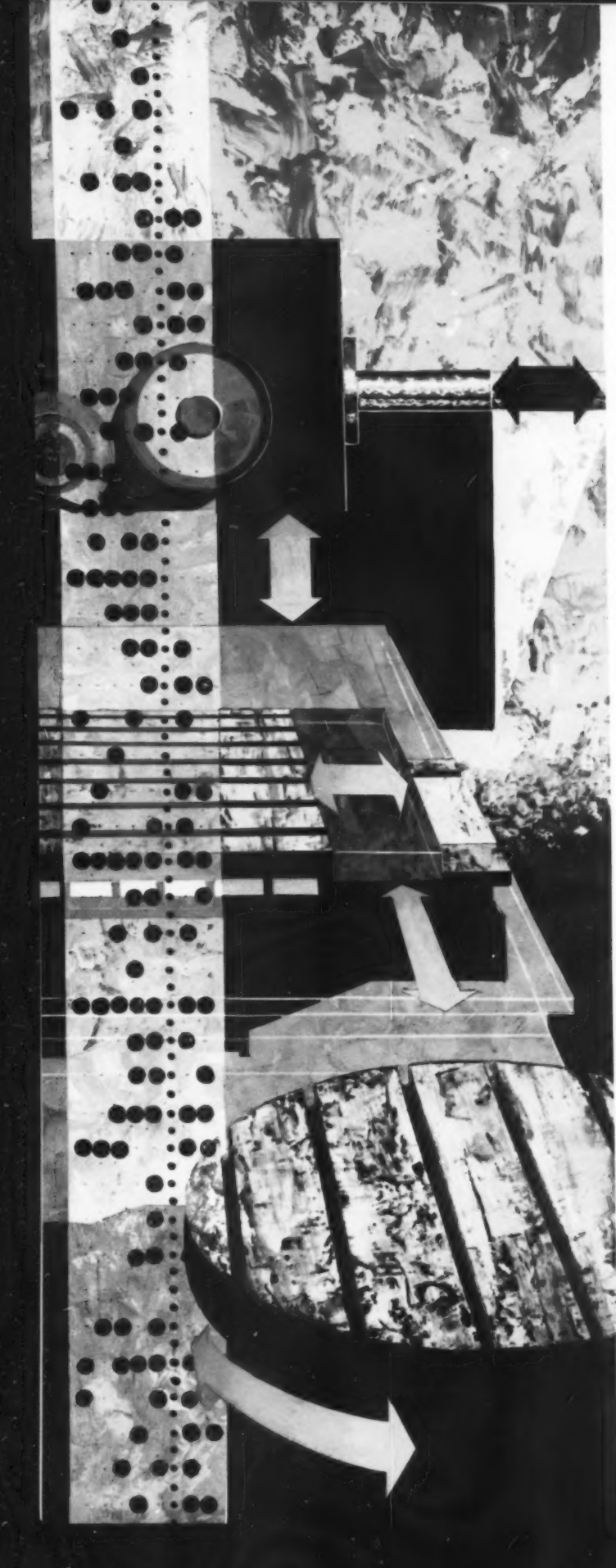
The new Model 275-40 presents every famous Lucas feature, *including saddle feed*, compacted into a 2¾" spindle machine specially suited for small, precision work. Any way you look at it, this new Lucas has the size and the machining versatility to fit into your shop or tool room setup. It's a truly profitable machine because it has so much and does so much. You get a built-in rotary table, tape programming if you want it, extreme accuracy for close tolerance machining and on-machine inspection, a new simplified control system, and many other features. Your Lucas representative can give you the whole story and arrange a demonstration right at the Lucas plant if you wish. Contact him or write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of precision machining small, intricate pieces . . .

think of . .



LUCAS
PRECISION



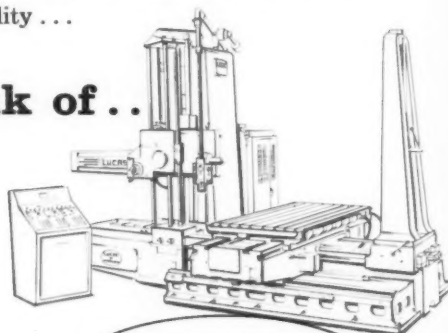


When you think of **PROFITABILITY**

... think of Lucas and tape. They're made for each other. Here's why. The Lucas machine can do more horizontal boring, drilling and milling work better than any other machine on the market. Couple this basic efficiency of a Lucas with the cost savings and reliability of tape control and you have an unbeatable combination for profitable work of the highest precision.

Lucas has applied numerical controls to its full range of boring, drilling and milling machines for a number of years. The various combinations of controls available have all been successfully applied by some of the most knowledgeable metalworking firms in the country. Your Lucas representative can discuss in detail some very interesting case histories and arrange a demonstration for you. Contact him or write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of profitability ...

think of ..



LUCAS
PRECISION

switch with one normally open and one normally closed contact. As the foot-pedal is depressed, the contacts are actuated (open contact closes and the closed contact opens) and remain in this position until the foot-pedal is depressed again.

The CR150 A7 reverse-sequence, two-stage foot-switch has two precision snap-action switches each, with one normally open and one normally closed contact which operate in reverse sequence to the standard CR150 A3 two-stage foot-switch. When the foot-pedal is depressed, the contacts of one switch will operate before the contacts of the second switch. Upon release of the pedal, the contacts in the switch that operated first when the pedal was depressed will again operate first.

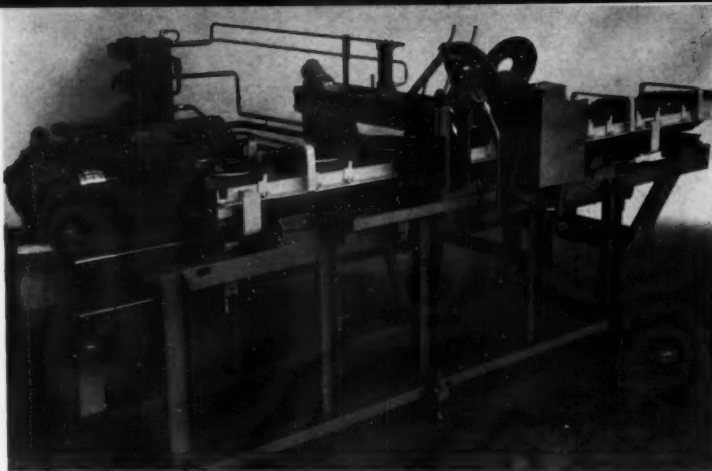
On both new forms the contact mechanism is enclosed in a heavy-duty, watertight and oiltight gasketed NEMA IV enclosure. Lead wires are brought in through a conduit opening provided at the rear of the switch enclosure. A removable top cover and adequate wiring space allow for easy installation. An optional foot-pedal guard is available to prevent accidental operation.

Circle 633 on Readers' Service Card

Livernois Work-Transfer Unit

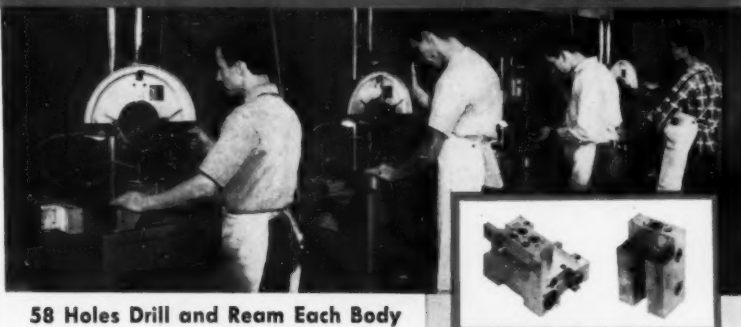
A transfer unit of the walking-beam type, built by the Livernois Engineering Co., Dearborn, Mich., has been incorporated in press-to-press automation of machines in a production line. The mechanism of this standard Livernois unit reaches into a press, removes the part (an automotive brake disc) directly from the piercing die, and progresses it along the line. At the center of the transfer unit is a turnover device which orients the part automatically for the next two operations. Incidentally, a new "wrinkle" and a cost-saving idea is introduced with a hydraulically powered piercing unit which performs an auxiliary piercing operation while the work-piece is transmitted between presses. After the piercing operation is performed, the work-piece is transferred into a staking die in another press.

The transfer unit is powered by



Transfer unit of walking-beam type built by Livernois Engineering Co.

BURGMASER Triples Valve Body Production ... Scrap Parts Reduced By Hundreds



58 Holes Drill and Ream Each Body

Micro Tool and Engineering Company, North Hollywood, California replaced six in-a-line spindle drills with 4 new Burgmaster Bench Model six spindle turret drills to triple the production of aluminum hydraulic valve bodies that required 58 drilled and reamed holes in each part. Two Burgmaster machines, using 10 of the available 12 spindles are now used to replace the six in-a-line single spindle drills for drilling and reaming 58 holes from 1/32" (30 diameters deep) to 5/16" diameter. Spindle speeds of 6200 rpm permit .014 drilling efficiently to 5/16" depth. The other two Burgmaster units are used to drill and ream a variety of hydraulic valve bodies. Savings on this project of 5 hours per part has been effected through the elimination of load, unload, positioning and drill change operations. The new 24 drill spindles now take up only 60 per cent of the floor space required by the original six single spindle machines.

WRITE FOR LITERATURE covering machines and accessories including the Burgmaster AUTOMATIC Bench Model Turret Drill with power feed and the new hand positioning table accessory. Dealers located in principal cities.

Job Facts

Company:	Micro Tool and Engineering
Machine:	Burgmaster Bench Model 6-Spindle Turret Drill
Parts:	Aluminum Valve Bodies
Operation:	58 holes drill and ream each
Holding:	Box Jig with Drill bushing
Former method:	Six single spindle drills
Present method:	2 Burgmaster Turret Drills
Advantages:	Triples production, eliminates scrap, cuts floor space. 66%.

Kearney & Trecker, C.V.A. Ltd., Sole Agents for Great Britain, British Commonwealth and Western Europe.



BURGMASER CORPORATION

Small Tool Div., Burg Tool Manufacturing Co., Inc.
13226 S. Figueroa St., Box 311, Gardena, Calif.
Phone: FAculity 1-3510 Phone, wire or write Dept.OA

a single hydraulic cylinder which actuates patented interlocking mechanisms that provide the upward and linear walking-beam motion. Since only one cylinder is used to provide both vertical and horizontal motions of the transfer unit, a much cheaper installation results.

A hydraulic pump and motor, as illustrated in the background, furnish the power for the transfer unit, the turnover, and the auxiliary piercing unit.

Circle 634 on Readers' Service Card



Machine for processing cylinder heads built by Foote-Burt Co.

For { **8-STATION PRODUCTION MACHINING**
1½" BAR AND COLLET WORK
CHUCKING
SINGLE POINT THREADING

This is an all new 1½" bar capacity ram type turret lathe with power feeds to all 8 working stations . . . that in addition to bar and collet work also has the versatility to do chucking, and when needed, single point threading. Powered by a 5 h.p., two-speed, geared motor, the new Sheldon 3 R turret lathe provides 16 spindle speeds, 60 different feeds to the carriage and cross-slide, and 180 different feeds to the ram turret. The turret itself is ruggedly built and accurately machined to provide close tolerance indexing. And for complete ease of operation, it is put under power by simply pressing a push button on the control panel.

Costs { **\$7,167⁰⁰**
FOB Factory
Complete with all
standard equipment

This new 3 R Sheldon is completely equipped with two-speed motor and electrical controls, coolant system and splash guards, LO spindle nose, large satin chrome dials and hardened bed ways. It also provides an additional cost saving feature—each turret face is drilled and tapped for your standard flange type tooling as well as being bored for your standard 1½" shank type tooling. For versatile, accurate machining in either long or short runs, the new Sheldon 3 R provides the answer to low investment cost with high profit operation.



Write for bulletin with complete specifications and tooling data

SHELDON MACHINE CO., INC.

4246 N. Knox Ave.

Chicago 41, ILL.

Builders of 10", 11", 13", 15" Sheldon lathes, Sheldon Milling Machines, Sheldon Shapers and Sebastian Geared Head Lathes

See us at Booth #1250 ASTME Show, New York Coliseum.

Foote-Burt Machine for Processing Cylinder Heads

A seventeen-station, sixty-four-spindle transfer machine designed to drill, ream, chamfer, spot-face, counterbore, core-drill, and tap holes in automotive cylinder heads has been built by the Foote-Burt Co., Cleveland, Ohio. This machine, which is only 46 feet long by 17 feet wide, accepts heads from the last station of a previous machine and deposits them at a forwarding index station for further processing. Production rate is 103 heads per hour at 80 per cent efficiency. Three stations are furnished with only one way unit each (all other stations have two way units each), leaving the opposite side vacant for additional units if desired.

All units of this machine employ hydraulic feed, except for one two-spindle tapping machine, which has a lead-screw and reversing motor. All heads slide on specially designed Foote-Burt double cylindrical ways. Chips cannot collect on these ways to jam the heads or mar the slides. Ten of the twelve units are equipped with pick-off speed-change gears to permit machining aluminum or cast-iron heads.

A lift-and-carry transfer mechanism positions the heads accurately at each station. The heads enter Station 1 aligned longitudinally with the direction of travel, but at Station 13 a rotating mechanism lifts and indexes the cylinder head 90 degrees, depositing it on the lift-and-carry cradle for transfer to succeeding stations. Control is through a master panel separate from the machine.

Circle 635 on Readers' Service Card



SOMETHING WRONG: (*same cutting speed . . .* *different costs!*)

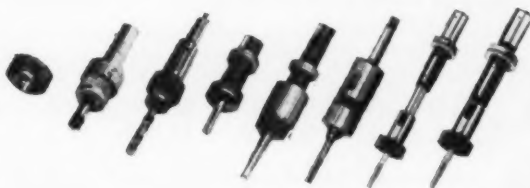
Yes, if feeds and speeds are set by machinability to get long tool life, something is drastically wrong. Because it just doesn't make sense to operate a \$1.50 drill in a \$3,000,000 transfer machine at the same speed as in a \$4000 upright. Not if you want least cost per piece. Simply stated: cutting speed should be that which gives you lowest combination of: (1) machine-hour charges and (2) tool replacement cost. Now, let's look at savings. Scully-Jones Quick-Change tooling reduces the highest increment of tool replacement cost—downtime for changing and resetting tools. The lower your tool cost, the faster you can run your machines. So both elements of total cost go down. We have designed Quick-Change, preset tooling for almost every kind of machine tool, and can design others for your special needs. The cost? You cannot find it in the price of a piecepart. Increased machine running time, alone, more than pays for the tooling. Call your S-J representative for application ideas and estimates.

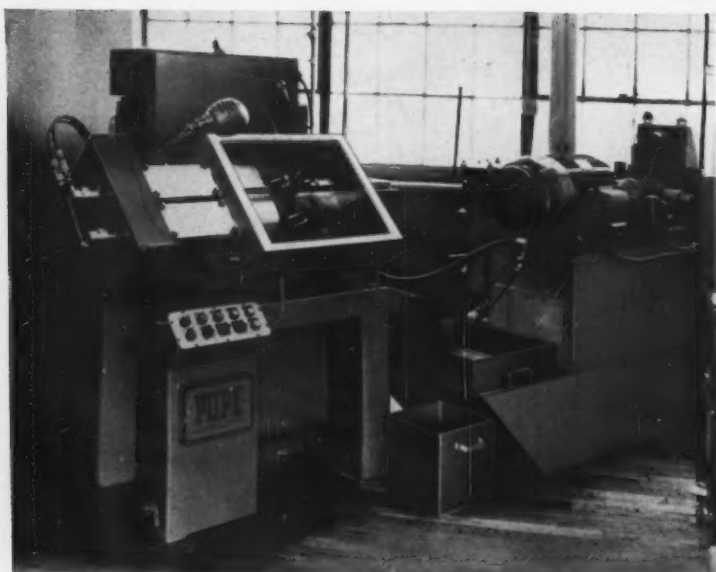
Scully-Jones and Company

1906 South Rockwell Street, Chicago 8, Illinois

**SCULLY
JONES**

**QUICK-CHANGE
QUICK-SET TOOLING**





Setup on Pope precision boring machine for drilling missile parts

Precision Boring Machine for Processing Missile Parts

Several holes must be drilled with extreme accuracy in valve sleeves used in the servomechanism that guides the Hawk Missile

in its supersonic flight. Superprecision boring machines built by the Pope Machinery Corporation, Haverhill, Mass., are employed

for this precision drilling work at the Raytheon Co's. Missile Systems Division plant at Andover, Mass. They operate at a pressure of 1800 pounds per square inch and at speeds from 3000 to 10,000 rpm, depending on the size of the drill, which may range from 0.100 to 0.750 inch in diameter. The table-actuating mechanism is entirely electrically controlled. Feed and traverse rates are infinitely variable.

For standard precision boring operations the Pope Model 16-9 boring machine is equipped with Pope superprecision boring heads capable of boring holes that are round within accuracy limits of millionths of an inch.

Circle 636 on Readers' Service Card

Overrunning Couplings

Overrunning couplings, suitable for freewheeling, indexing, or backstopping applications, are now available from International Mechanisms, Fairport, N. Y. Their direction-sensing element is a precision heat-treated steel spring, wound so that it has a slight interference fit on the carbo-nitrided clutch hubs. This design insures a large driving surface and low overrunning pressures. If turned in the driving direction, the spring tightens, torque is built up exponentially along the spring, and the coupling engages with a very slight amount of backlash and drives without slip. In the overrunning direction, the spring unwinds slightly, allowing one hub to slip with respect to the other.



Overrunning couplings made by International Mechanisms

All units come complete with sintered bronze swivel bearings, plastic locking type set-screws, and aluminum dust covers. Stock sizes for shafts from 1/8- to 1-inch diameter are available for immediate delivery.

Circle 637 on Readers' Service Card

THESE BENEFITS ARE YOURS



when your drills are sharpened on

the Model 100-A

W ...extremely true, close-tolerance holes within .001 of drill size (even in the new super-metals) since drill points are concentric within .0002.

W ...precision conventional chisel type drill points as well as helical (self centering) drill points essential to optimum performance on tape controlled drilling machines.

W ...increased production from every drill because drills last up to twice as long.

W ...elimination of most reaming requirements.

W ...faster, more precision drilling with fewer rejects.

Get these benefits...and many more with the completely automatic WINSLO-MATIC DRILL POINTER. Handles drills from 1/32" to 1 1/2" diameters.

WINSLO-MATIC DRILL POINTER



Write for descriptive literature and check for yourself the many exclusive advantages of the versatile WINSLO-MATIC Drill Pointer.

Winslow **PRODUCT ENGINEERING CORPORATION**
47 ST. JOSEPH STREET • ARCADIA, CALIFORNIA

Floturn Machine for Shear-Forming Light-Gage Metals

An extremely compact Floturn machine specifically designed for shear-forming light-gage metals has been announced by the Floturn Division of Lodge & Shipley Co., Cincinnati, Ohio. This No. 12 horizontal Floturn is said to represent the latest in low-cost, precision metal-forming equipment, featuring all-hydraulic operation, including automatic hydraulic tracer control of its single forming roller. Typical examples of work handled by this new machine include: utensils, light reflectors, and cooking and scientific ware (skillets, bowls, tumblers, beakers, funnels, graduates, and shot glasses). It employs the Lodge & Shipley Floturn principle of metal-forming to produce parts ranging up to 12 inches in diameter and 15 inches long. The machine itself is approximately 10 feet long, 4 feet wide, and 6 feet high. Equipment includes an eight-speed spindle drive from a 15-hp motor or a variable-speed drive.

The machine has many of the features of the large Floturn machines used to form defense "hardware" such as the body of the Minuteman ICBM. Among these features are: a rugged headstock with precision oversize bearings and automatic lubrication, automatic cycle operation, yieldable tailstock, reversible roller head, 60-degree roller slide, adjustable feed cams, coolant system, and two hydraulic systems.

Circle 638 on Readers' Service Card

Corrosion-Resistant High-Strength Steels

High-strength, columbium-treated steels with added atmospheric corrosion-resistance treatment are being marketed by Jones & Laughlin Steel Corporation, Pittsburgh, Pa. The addition of copper (0.20 minimum) to the columbium-treated grades—designated JLX-45-W, JLX-50-W, JLX-55-W, and JLX-60-W—provides a level of atmospheric corrosion resistance approximately twice that of mild carbon steel and equal to the level found in some of the high-strength, low-alloy proprietary grades.

J&L columbium-treated steels

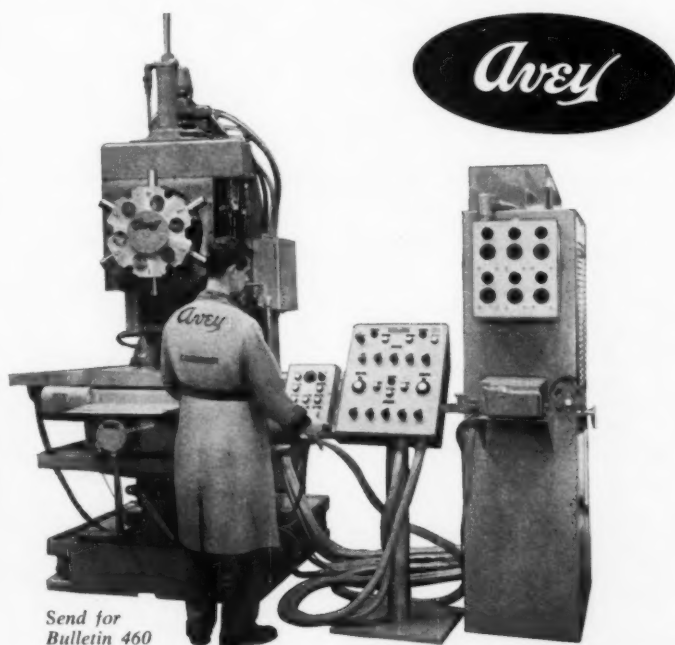


Lodge & Shipley horizontal Floturn precision metal-forming machine

have minimum yield properties for these respective grade designations of 45,000, 50,000, 55,000, and 60,000 pounds psi. Both the regular columbium-treated and

the copper-bearing grades are available in gages and sizes approximately paralleling those in which Jalten (a high-strength, low-alloy grade) is sold. They are

6 precision spindles by



Send for Bulletin 460

You can get this rugged Avey 250 Turret-Dex with either automatic or numerical controls. Rotary, 2- or 3-axis positioning. Pre-selected speeds, feeds, rapid advance, tapping cycles. Automatic depth control all spindles; automatic turret clamp; positive spindle stop; skip index. Capacity to 1 1/4". Eight spindles optional. Avey, Box 1264, Cincinnati 1, Ohio.

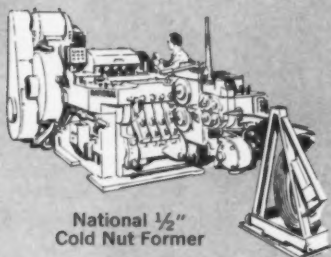
TOUGH NUTS!



These unusual nut blanks are formed *automatically* — on compact, efficient National Cold Nut Formers.

Quality is excellent, scrap is low and remarkable savings are realized over other methods.

Send us your "Tough Nut Projects." Better yet, come to Tiffin where we can concentrate on *your* nut production. No obligation.



National 1/2" Cold Nut Former

(Available in sizes 1/4" through 1")

NATIONAL MACHINERY CO.

TIFFIN, OHIO, U.S.A.

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Circle this page number on card

available in plates up to 3/8 inch thick, inclusive; in both hot- and cold-rolled sheets; and in hot-

rolled bars, small shapes, and some structural shapes.

Circle 639 on Readers' Service Card

Ex-Cell-O Lectra-Form Machine

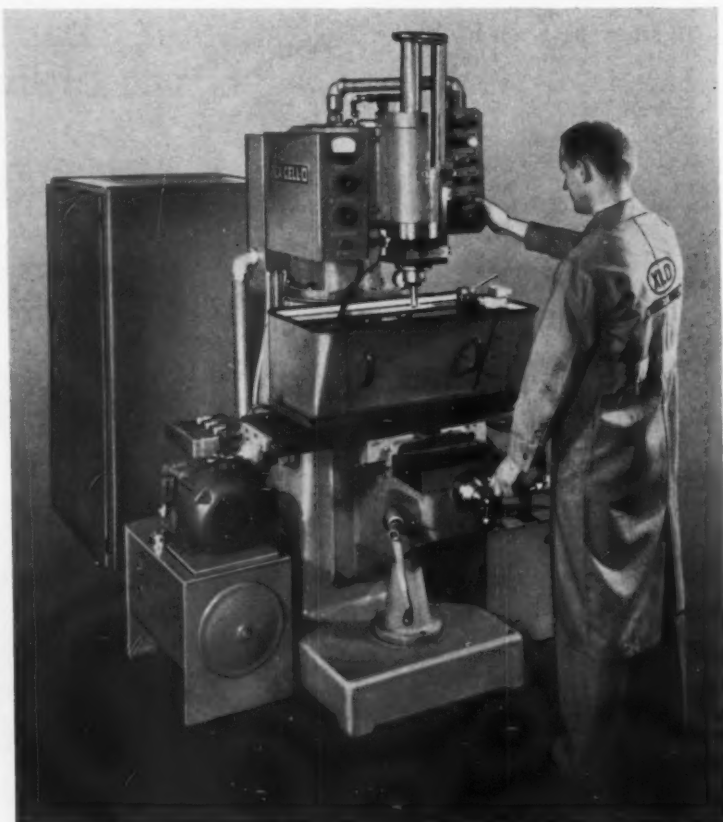
By departing from conventional metal-cutting processes and introducing its Lectra-Form machine, the Ex-Cell-O Corporation, Detroit, Mich., has recently reduced production time on an aircraft part from forty to only eight minutes. Other advantages include a more uniform wall thickness around the recess and a better surface finish. Also, scrap has been virtually eliminated and tooling and fixturing are said to be simpler and far less expensive. Previously the recess was patiently end-milled with a tiny cutter. The material was a high-nickel alloy steel and tool mortality was high, accuracy unreliable, and the material work-hardened during the machining operation.

With the Ex-Cell-O electrical-

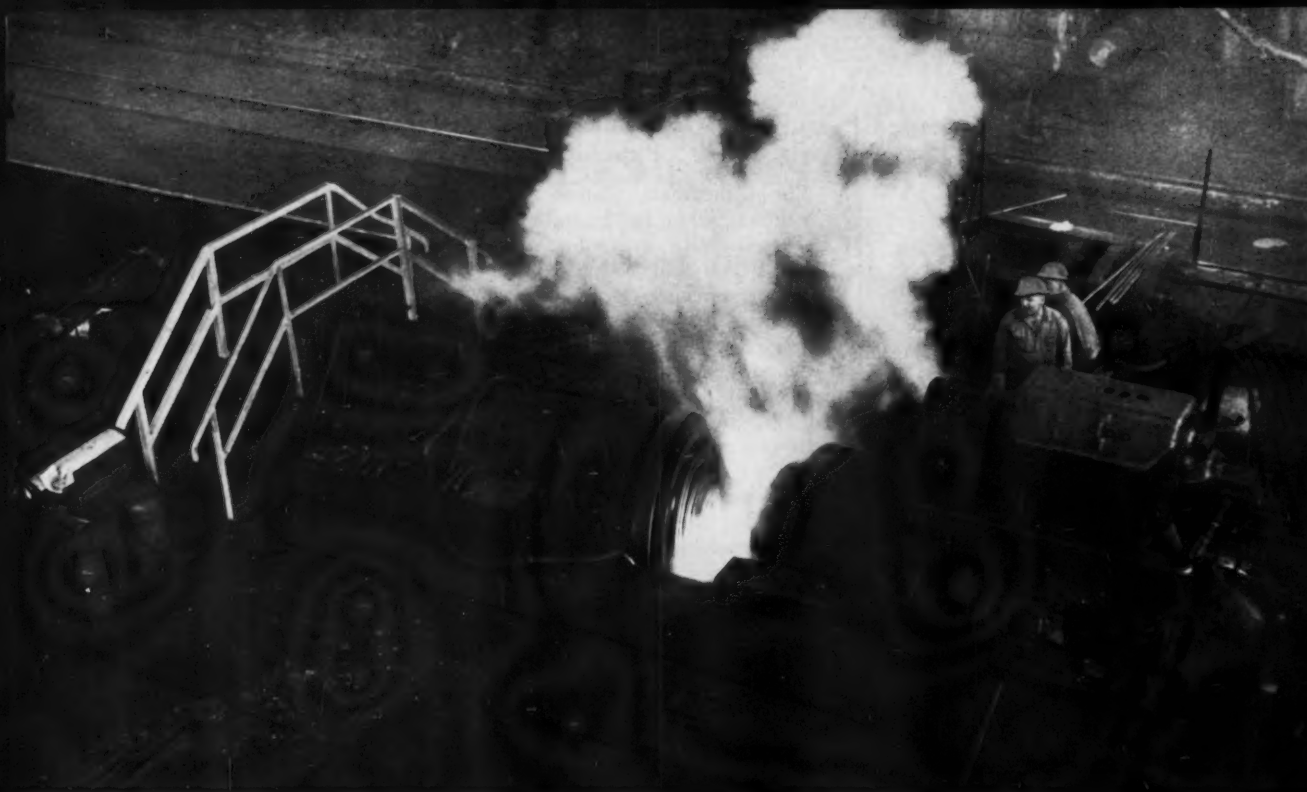
discharge process both the tool and the work-piece are submerged in a dielectric fluid. In operation the tool, or electrode, is fed into close proximity with the work to be processed. The controlled removal of metal is accomplished by a series of momentarily heavy electrical discharges across the gap between the tool and the part. At the conclusion of the machining cycle the inverse image of the tool is formed in the work.

The Ex-Cell-O Lectra-Form machine is also being used to perform many machining operations otherwise considered impractical by conventional methods. It can be used to advantage in machining hardened materials, tough materials, and parts with intricate shapes.

Circle 640 on Readers' Service Card



This Ex-Cell-O Model 244 Lectra-Form machine is equipped to process a tough, work-hardening aircraft part



START: Heated billet is centered between dies of the Slick Mill.



15 SECONDS
Upset-forging starts.



30 SECONDS
Rolling cycle starts.



40 SECONDS
Forging is completed.



55 SECONDS
Forging is removed from mill.

One minute...one circular forging

That's all the time it takes to convert a heated billet (100 to 2,000 lb) into a contoured forging on Bethlehem's unique Slick Mill.

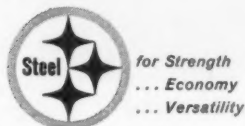
But fast operation is only one reason why Bethlehem's Slick Mill turns out a top-quality forging at a price that's hard to match.

Ask us, or our nearest sales office, about the quick die changes, which make it possible—and economical

—to set up production runs as small as 25 or 50 pieces. Ask about the low die charges which are made possible by the brief contact between die and work. Ask about the light-weight sections this mill can produce, without sacrificing strength.

We'd also like to tell you about the excellent grain flow, machinability, and soundness of every Bethlehem circular forging.

Ask. You'll like the money-saving answers.



BETHLEHEM STEEL COMPANY, Bethlehem, Pa.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



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and
Economy
Use**

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Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

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Muncie Division, Muncie
Link-Belt Company, Indianapolis 6
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**These companies are members
of the Malleable Castings Council**

**Hydraulic Press Brake Serves Also as
Punching and Bending Machine**

The Cincinnati Shaper Co., Cincinnati, Ohio, has brought out a Series 300H hydraulic press brake which will be utilized as both a punching and bending machine. Ram angle-brackets, combined with a permanently widened bed equipped with die cushions, plus the extended bed and ram provide this press brake with exceptional versatility. For operator convenience, all machine controls are mounted at the right-hand end of the machine. The ram has two speeds—one a fast pressing speed, and the other, a full-tonnage pressing speed.

The distance between housings is 10 feet 5 3/4 inches, and the total over-all die surface, 15 feet. Bending capacity is 3/8 inch by 10 feet for mild steel. The ram has a stroke of 18 inches. Throat depth is 10 inches, and open height, 29 inches. There is a 36-inch extension at the left end of the bed and ram. The bed has been permanently widened to 36 inches. The ram is planed and

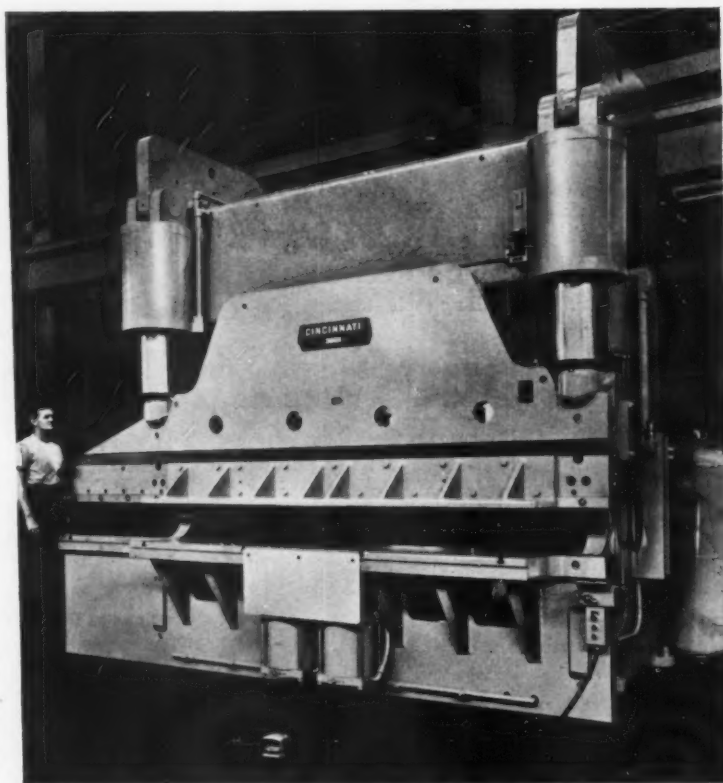
drilled for 12-inch high angle-brackets. Cylinders are clevis mounted.

The hydraulic manifold block reduces piping and connections to a minimum. There is a tonnage indicator and tonnage control protection for the dies. Red and green lights predict direction of ram movement. A bottom of stroke control reading in thousandths of an inch is located in front of the machine, convenient to the operator. Automatic leveling control to the ram has enclosed tape and direct-acting servo. Ram-tilt control reading in thousandths of an inch is provided for fade-out work. Electrical operating equipment has a rating of 30 hp.

Circle 641 on Readers' Service Card

**Low-Cost Abrasive for
Finishing Crankshafts**

Improved finishes with pronounced savings in the cost of lapsing are said to be achieved in



Hydraulic press brake brought out by Cincinnati Shaper Co.

Malleable Puts More Muscle in Machinery

In the agricultural equipment field, reputations depend on building products that can take rough treatment . . . and give real value. To do it, agricultural equipment manufacturers rely heavily on Malleable iron castings.

Malleable's excellent ductility and shock resistance mean longer life and fewer problems than obtainable with fabrications. Low start-up cost for small quantities also is vitally important in this competitive industry.

Put more reputation-building quality into your products at less cost with Malleable. For design assistance or quotations, call any company that displays this symbol —



PROBLEM-SOLVING IDEAS are yours free in Data Unit No. 115. For your copy, ask any member of the Malleable Castings Council, or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.



The versatility of Malleable castings is reflected in the variety of ferritic and pearlitic Malleable tractor parts, from the tough, dependable front axle bar to bolsters, lift arms, clamps, clevises, hitches, hinges, foot pedals, transmission planetary carriers and clutch parts.

Whenever numerical control is justified... Monarch "mates" Lathe to Pathfinder Control... Results: full accuracy, capacity



Where lathes are concerned, the economics of Numerical Control require the consideration of these factors:

1. The number of individual jobs to be run.
2. The complexity of work piece geometry.
3. The allowable time lag between completion of drawings and completion of machining.

Full path control of the tool is a basic requisite. As provided on the Monarch Pathfinder, this enables the user to realize the many advantages of Numerical Control. They are:

- Only a few minutes shop set up time per job. Manufacturing costs greatly reduced on small lot work. Substantial inventory reduction possible.
- Complete machine cycle under tape control. Operator error eliminated. Absolute uniformity of results.
- Up to six different tools may be programmed for a variety of cuts. Complex shapes and extreme undercuts turned

quickly without costly form tools. Often separate operations on other machines eliminated.

- Programming can immediately follow completion of drawings. No long wait for templates or other special tooling. Storage of tape for future use easier, safer and less space consuming than templates.

We believe that a successful Numerical Control Lathe combines machine and control that have been *properly matched* by the machine tool builder to the specific requirements of the job. Response of the control must be such that the machining capacity of the lathe is not limited; accuracy of the lathe such that the full accuracy of the control is realized. The Pathfinder Numerical Control Lathe is such a combination.

Ask us to evaluate whether a standard lathe, tracer control or numerical control is best for you. We offer all three. For over 50 years our engineers have specialized on fitting lathe to job for user profit and satisfaction. The MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO.



Monarch
TURNING MACHINES

ASK ABOUT THE MONARCH DEFERRED PAYMENT AND TOOL LEASE PLAN

processing crankshaft journals for the engines of 1961 cars by the use of new paper-backed coated abrasive rolls in place of the cloth-backed rolls previously employed. The new 50-yard abrasive rolls, developed by Behr-Manning Co., Troy, N. Y., a division of the Norton Co., uses a backing which is impregnated to add tensile strength, pliability, and tear resistance. Because these rolls run in oil, yet must operate without slippage, an antislip sizing was applied to the backing.

In sustained testing, the paper rolls have outperformed the cloth-backed abrasives in micro-inch readings of finish and in other respects, at considerably lower cost.

Circle 642 on Readers' Service Card

Compact Variable-Speed Motor-Drive Unit

Exceptional compactness has resulted by combining a motor with a mechanical variable-speed drive manufactured by the Cleveland Worm & Gear Division, Eaton Mfg. Co., Cleveland, Ohio. Utilizing an integral "pancake" style motor, this new Motorized Speed Variator, as it is called, requires only slightly more space than an equally rated conventional motor. The new line is available in sizes from 1/3 to 15 hp. Motors are of alternating-current, radial air-gap design and conform to NEMA design "B" specifications.

The unique design of this unit insures precise speed setting and repeatability. It provides variable output-speed ratios within 9-to-1 and 6-to-1 ranges. Since it employs the rolling action of a series of balls, it permits smooth adjust-



Motorized Speed Variator unit



BY THE TIME YOU FINISH YOUR SMOKE

Step into any plant equipped with a Danly Quick Die Change Press—and watch! You'll see the Q.D.C. change dies in less time than a cigarette takes. As one self-propelled bolster assembly rolls the old die out of the press, another one rolls the new die in. And the press goes right back into production on a new part. Think of the hours of profitable production you'll gain with this time-saving Danly development. Think of the efficiency you'll get on short-run production. And while you're thinking about it, decide right now to find out more about the Danly Q.D.C. Press.



BULLETIN Q.D.C.-1 Tells how the Danly Quick Die Change Press can drastically reduce your die change downtime. Write for your copy.



PRECISION PRESSES, DIE SETS AND DIEMAKERS' SUPPLIES

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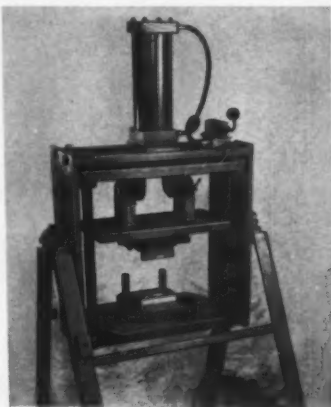
ment of the output speed while operating under load.

Power is transmitted through the input shaft to a beveled drive disc in contact with axle-mounted alloy-steel drive balls. Input shaft rotation causes balls to rotate about their axles, which in turn transmits power to the output shaft by a similar ball-disc contact. Output speed is determined by relative lengths of the contact paths on input and output sides of the balls. By tilting both axles and balls, relative lengths of the two contact paths are varied to give increasing or decreasing ratios.

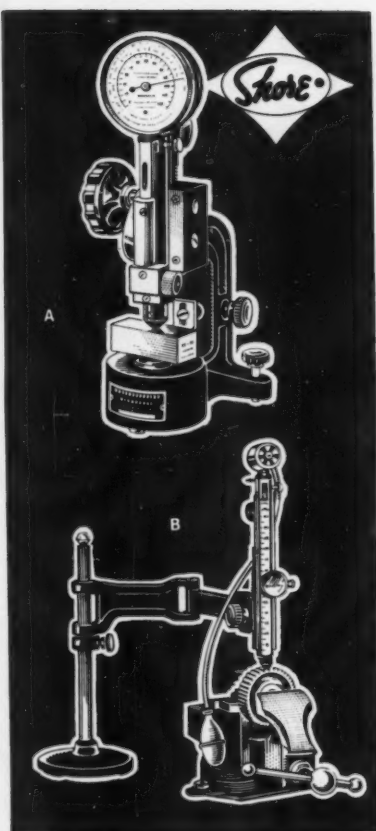
Circle 643 on Readers' Service Card

Portable Pneumatic Spotting Press

Spotting press, developed by the AceWeb Tool & Mfg. Co., Dearborn, Mich., to facilitate the spotting of punches and pads on dies



used to manufacture all types of small metal stampings. This press can also be used for short-run sub-assemblies and prototype work. Two models are available, No. 100 and No. 150. To facilitate work on dies, the complete unit can be tilted 360 degrees to any desired angle and locked in position. The punch-retainer is designed to swing forward or backward 90 degrees and is locked in position to bring work directly in front of the operator. The press is completely portable, being mounted on casters so that it can be moved to the most desirable working area. Model No. 150 is equipped with inching controls for use in spotting plasters, plastics, etc. Gages attached to the frame can be set to any pressure required.



HARDNESS TESTING

Shore's Improved Direct Reading Scleroscope and Standard Recording Scleroscope with dial graduated in standard Scleroscope and equivalent Brinell and Rockwell "C" Hardness Numbers, are able to perform over 1000 hardness tests per hour. Both Scleroscopes are completely portable, operative on all types and sizes of metals, are reliable in hands of non-technical help, and show no visible injury signs on finished surfaces. Write for free brochures on these instruments.

A Standard Recording Scleroscope with Clamping Stand, jaw capacity 3" high x 2 1/2" deep. Supplied with following accessories: diamond hammer, hard and soft test block, V block for testing rounds, and steel carrying case.

B Direct Reading Scleroscope shown above with special Swing Arm & Post Assembly. Height capacity 9", reach 14". To be mounted on bench for testing large objects. Supplied with two test blocks and diamond hammer.



Let us send you complete specifications

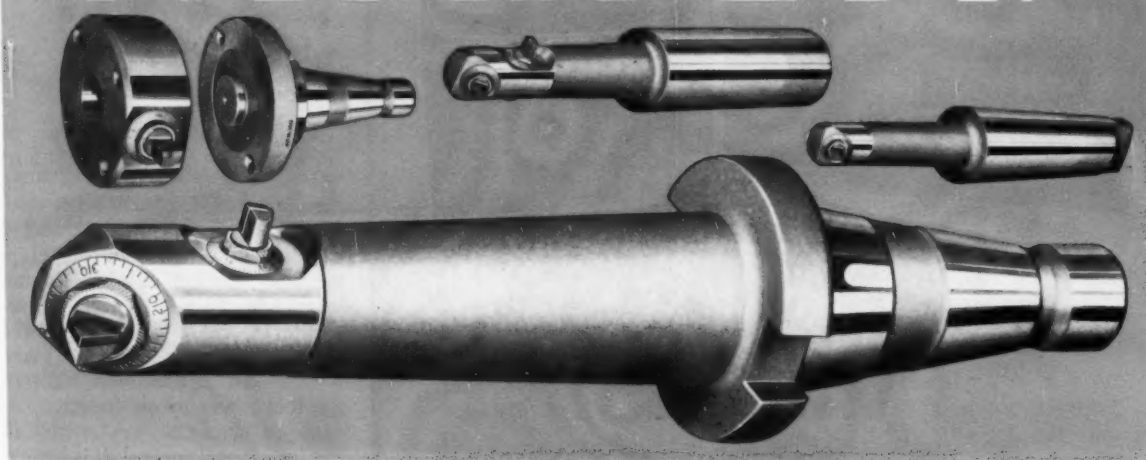
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Whatever your tapping problem with super-strength alloys, the Winter Service Engineer will recommend the *right* Balanced Action taps for the job. Just send a description or print of the work, the material to be tapped and the Rockwell C-scale rating.

Write, too, for a copy of "Metal Cuttings," which comprehensively covers tapping of super-strength alloys.

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Rochester, Michigan, U.S.A.

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Choose from
Winter's Wide Line of
Taps, Dies and Gages

CALL YOUR WINTER DISTRIBUTOR

The punch-retainer has adjustable positive stops. Capacity is approximately 1/2 ton; and the table size, front to back, is 12 inches and left to right, 19 inches. Ram height above table in open position is 11 inches, and in closed position, 1 3/4 inches. Over-all size, front to back, is 35 1/2 inches, left to right, 29 1/2 inches, and height, 5 feet 10 inches.

Circle 644 on Readers' Service Card

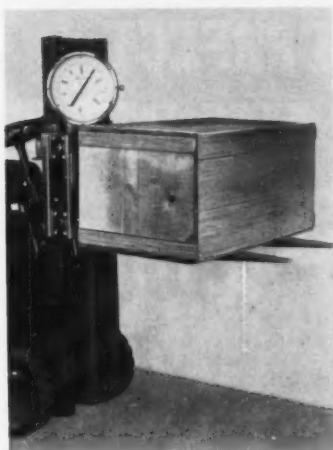
Kendex Profiling Tool with Dial-Adjusted Chip-Breaker



Kendex profiling tool with double-locked carbide insert and a dial for adjustment of the chip-breaker announced by Kennametal Inc., Latrobe, Pa. The principal feature of this tool is the positive locking of the insert. First, it is locked against two walls of the tool recess by an eccentric, or cam-pin, through a center hole in the insert; and second, it is locked in its seat by a top clamp held by a socket-head cap-screw. The insert will not be pulled out while back-facing or contouring. New to this type of tool also is easy and precise adjustment of the chip-breaker with Kennametal's "Dial-A-Breaker," which was introduced in 1960 for standard Kendex insert tooling. To simplify changing, indexing, or inverting the insert, the chip-breaker is raised by a spring plunger when the clamp is released. Diamond-shaped inserts have a 55-degree nose angle and are set in the holder at a 5-degree negative side and back rake to provide four cutting points. The insert is pulled away from the recess walls when the cam-pin is loosened by a wrench on the bottom of the tool-holder. Three styles of holders that meet most machine tool requirements are available from stock.

Circle 645 on Readers' Service Card

Mobile Scale for Fork Lift Truck

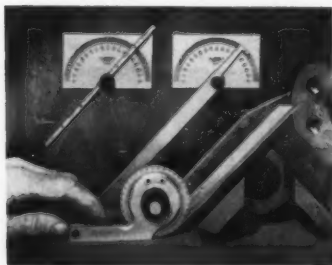


"Hydroscale" unit, which can be quickly installed on any make of fork lift truck (new or old), introduced by Hydroway Scales, Inc., Madison Heights, Mich. This new weighing unit has been designed to serve a long-time need for an accurate, rugged, and dependable scale unit for lift trucks. It can be lock-clamped in place in a matter of minutes. Models are available for either the bracket type or the bar type fork mountings, and with scale capacities ranging from 1000 to 6000 pounds. This unit, attached to a lift truck, provides all the advantages of a mobile platform scale. The scale is guaranteed to be accurate within 1/2 of 1 per cent of the scale capacity.

Circle 646 on Readers' Service Card

Starrett Protractor with "Satin-Chrome" Finish

Universal bevel protractor No. C359 of new line of steel protractors and protractor-depth gages offered by the L. S. Starrett Co., Athol, Mass. These measuring in-



MACHINERY, May, 1961



spline-taper drive
**INTERCHANGEABLE
COUNTERBORING
TOOLS***

rugged, economical,
permanently aligned

National



National Spline-Taper Drive Counterboring Tools offer real on-the-job economy for heavy duty counterboring operations. A single, rugged shank and holder socket accommodates a wide range of counterbore and countersink cutters, thus keeping tooling costs at a minimum.

Taper shank and socket construction assure permanent alignment and rigidity. Spline keys offer jam-proof, twist-proof performance, even under severe conditions.

Manufactured in a complete selection of individual stock sizes, National Counterboring Tools are also available in five basic assortments to meet the requirements of most tool rooms and small shops. Investigate these rugged, economical tools from National today . . . your only source for tools "plus"!

NATIONAL TWIST DRILL & TOOL COMPANY

Rochester, Michigan, U.S.A.

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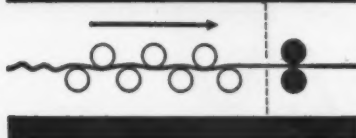
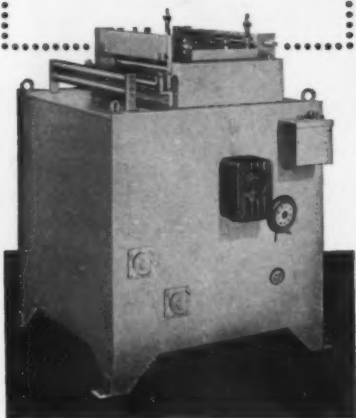


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223

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1835 West Rosecrans Avenue, Gardena, Calif.

For more data circle Item 224A

struments feature no-glare "Satin-Chrome" finish for easier reading and high resistance to corrosion and wear. The protractor illustrated is available with 7-, 12-, or 7- and 12-inch blades. It has Satin-Chrome finish on the protractor dial and vernier. Other surfaces are bright chrome except the blades and acute-angle attachment. No. C359 with vernier, ultrafine adjustment, and acute-angle attachment measures angles as close as 5 minutes or 1/12 degree. No. C364 universal bevel protractor also features Satin-Chrome finish on protractor dial and vernier. It is similar to No. C359 but without fine adjustment. Satin-Chrome finish is also available on protractor head and blade of Starrett No. C183 steel protractor and No. C493B protractor and depth gage.

Circle 647 on Readers' Service Card

High-Speed Milling Cutter



Milling cutter developed for either rough- or finish-milling cast iron where high cutting speed and feed are required. This new Series 7100 "Rigidcut" face mill brought out by the Wesson Co., Ferndale, Mich., is said to permit drastic reductions in machining time. It is claimed that processing can be done faster and that the shape of the brazed-carbide cutter blade permits either roughing or finishing actions, depending on adjustment. Heavy high-speed cutting is achieved by the use of large, husky blades having a generous chamfer on the end. Because the corner angle on the fine-pitch blades used in these cutters is 3/8

You can be sure of

**PERFECT
ALIGNMENT**

WITH

ROOFE

Heavy

Duty

Bull Nose

Centers



Accuracy, dependability, and economy are the watchwords in manufacturing ROOFE Heavy Duty Bull Nose Centers. And users come back again and again because they increase production and lower costs. Double rows of ball bearings in the large and small ends of the centers mean perfect alignment on any type of work.

Two shank sizes provide diameters from 1/2" to 7 1/2" for a variety of work with a single center.

**HOUSTON GRINDING
& MFG. CO., Inc.**

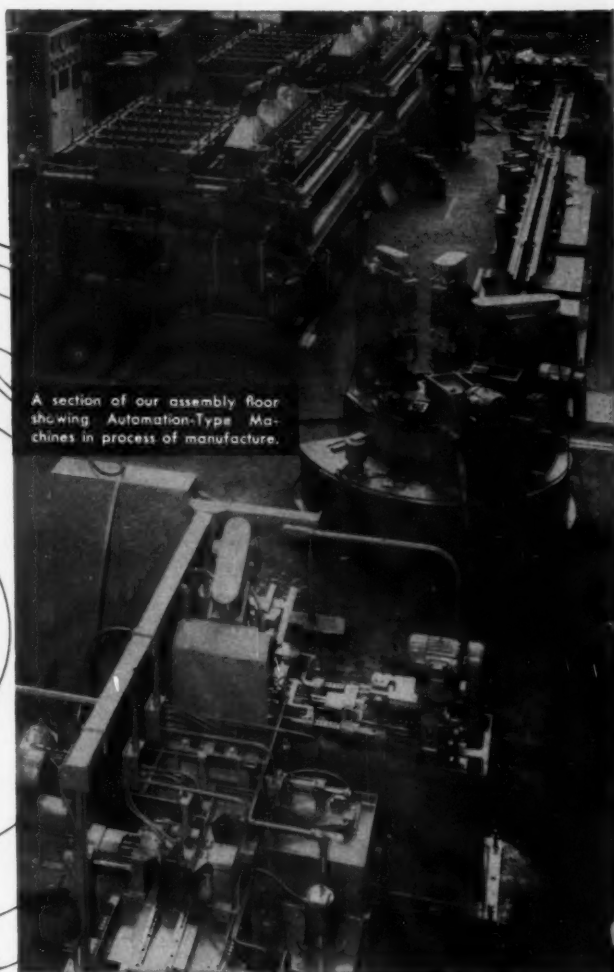
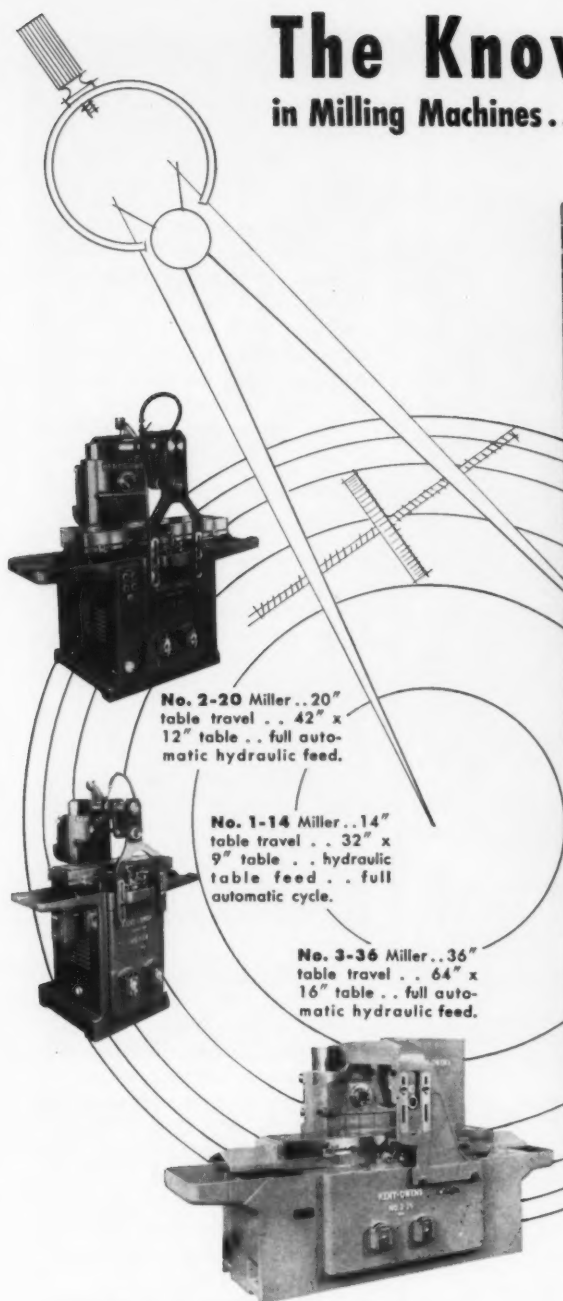
P. O. BOX 7461 - HOUSTON 8, TEXAS

For more data circle Item 224B

MACHINERY, May, 1961

The Know-How Dimension

in Milling Machines..Special Machinery..Automation Equipment



.. makes the difference in cutting costs .. increasing production

Know-How, born of years of experience, abetted by sound and imaginative design and quality manufacturing standards . . . is the reason why many of our customers, representing a wide and diversified coverage of industry, come back to us again and again for answers to their production problems.

When you are considering procurement of machinery for your milling needs . . . or seeking the solution to

other production problems . . . you may wish to consider a Kent-Owens Milling Machine or a Special Machine designed for a distinctive and individual application. Contract Machine Building (customer designed equipment) is another of our specialties.

Write or call . . . Kent-Owens will be pleased to quote your requirements. Kent-Owens Machine Company, Toledo 10, Ohio.

KENT-OWENS

*Designers and Builders of
Milling Machines and Special Machinery*



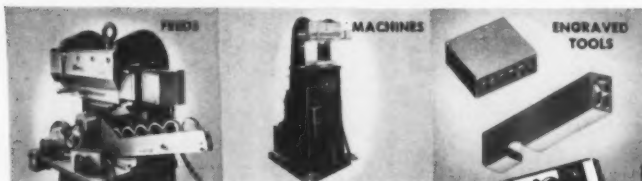
MARK FREIGHT CAR WHEELS OR PEN POINTS

ECONOMICALLY, AUTOMATICALLY WITH GTS MARKING EQUIPMENT

Whether you need an automated 250 ton unit for marking hot, pressure cast railroad car wheels or a machine for marking parts as delicate as a fine pen point, SCHMIDT has the experience and facilities to provide the right equipment for the job.

The in-line production marking machine above accepts hot (1200° F.) car wheels, positions and marks with consecutive serial number and other data in deep permanent characters—and discharges wheel to conveyor for next operation.

COMPLETE LINE OF MARKING EQUIPMENT



Single machines or entire automatic marking stations including machines, feeds and lettering tools—are engineered, designed and produced to meet your requirements.

Free consultation with a qualified marking engineer can be arranged promptly. Send today for Catalog No. 18.



IF IT'S WORTH MAKING, IT'S WORTH MARKING

GEO. T. SCHMIDT, INC.

Engraved Marking Tools • Nameplate Marking Equipment
Embossing Dies • Special and General Purpose Marking Machines

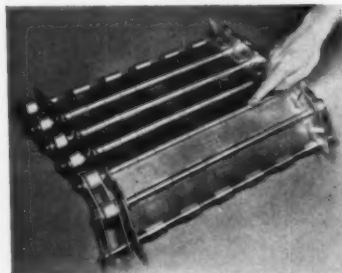
4102 N. Ravenswood Avenue • Chicago 13, Illinois • Phone: EA 7-0300

inch by 45 degrees, the cutters should be used on fairly heavy cuts—up to 5/16 inch. For finishing, the 5/8-inch face of the blade can be ground, either to be free cutting or to provide a surface with an extra-fine finish. Series 7100 cutters are available with effective diameters increasing in increments of 1 inch from 6 to 20 inches. All Series 7100 cutters are available with a standard Wesson drive; those over 8 inches in diameter can also be furnished with National Standard drive.

Circle 648 on Readers' Service Card

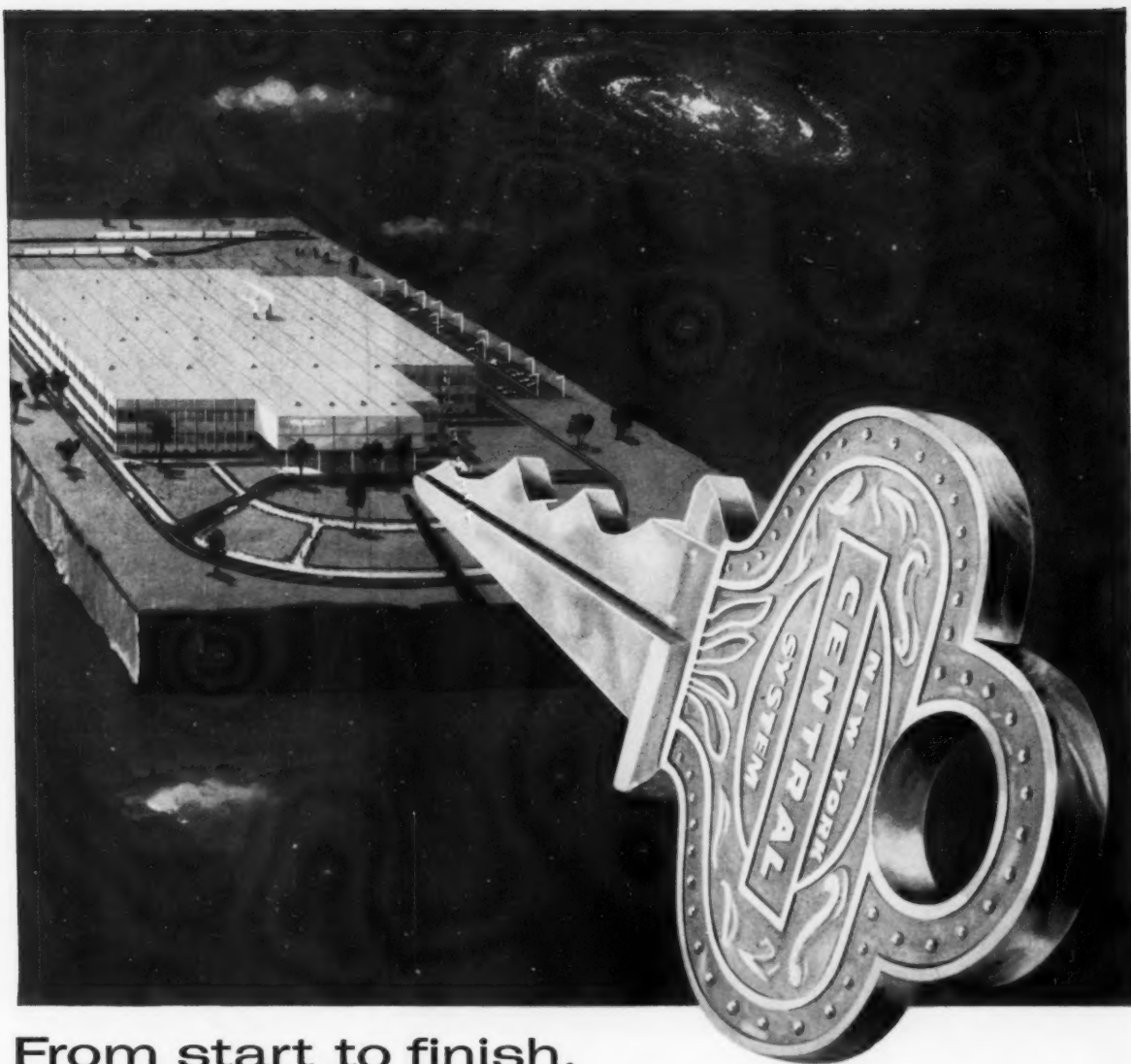
Heavy-Gage Hinged-Steel Belting

Hinged-steel heavy-duty conveyor belting brought out by the May-Fran Mfg. Co., Cleveland, Ohio. This conveyor belting has spe-



cially designed short-pitch belt links. The new link design is compatible with existing conveyors using hinged-steel belting. The shorter-pitch link permits a considerable reduction in over-all section depth of conveyor designs. Fabricated from 1/8-inch thick steel, each individual link has a 2 1/2-inch pitch, which allows the assembled hinged-steel belt to run on sprockets with a pitch diameter as small as 5 inches. As a result, over-all conveyor depth can be as little as 8 1/2 inches. Individual links are produced in widths up to 18 inches. The belting was developed for handling materials such as nuts, bolts, stampings, castings, and other items which are not big physically but heavy in weight. For elevated temperature applications, such as conveying hot metal parts, the link clearances are made slightly larger. Belting made from the new link design can also be supplied in other materials for special conveying requirements.

Circle 649 on Readers' Service Card



From start to finish,
the New York Central will create your
new plant with **Operation Turnkey!**

Whether your business is large or small, the Central's "Operation Turnkey" will handle all your new plant problems—from helping arrange finances to handing you the key to the front door.

Service includes: site location, help in getting credit, technical counsel and contractor supervision. Everything is tailored to your specific needs. Move in as owner, lessee, or on a rental-purchase arrangement.

If you don't need a whole building, or you want to be near related industries, we can still help. "Turnkey" coordinates the needs of all kinds and sizes of businesses, brings them together as neighbors. "Operation Turnkey" can be a giant step on your road to the future.



ROAD TO THE FUTURE

Take that important step forward—call or write: Otto W. Pongrace, Dept. 4,
N. Y. Central, 466 Lexington Avenue, New York 17, N.Y., MUrray Hill 9-8000



Power

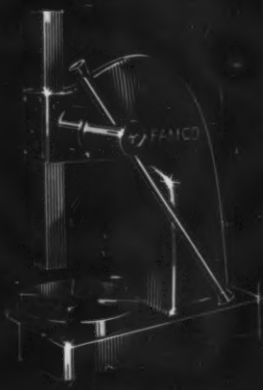


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Presses for any situation



Hydraulic



Manual

Famco, the only press manufacturer that gives you so much selectivity. A press for any situation—air, power, hydraulic, manual.

Famco presses are quality! They defy maintenance. Their precision never varies, even under continuous pounding. They help you most, right where it's needed—in your pocket.

Whatever you need in presses—see Famco's top quality long line first or contact us for a solution to your problem.

Send for our press brochure.

Products of Famco

Squaring Shears, Milling Machines, Tracer Mills, Band Saws



MACHINE COMPANY

KENOSHA, WISCONSIN

Link-Belt "Multi-Bearing" Take-up Frames

"Multi-Bearing" take-up frames, available from stock in eleven sizes from the Link-Belt Co., Chicago, Ill. These frames are espe-

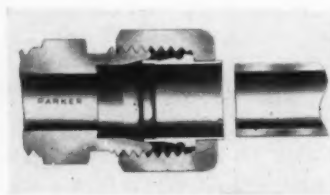


cially designed to accommodate any type of bearing—babbitted, bronze, ball, or roller—in any two-bolt pillow block with mounting holes up to the 5/8-inch size. The frames allow horizontal bearing adjustments from 6 to 24 inches. More than 140 different bearing-shaft sizes ranging from 5/8 to 2 7/16 inches in diameter can be mounted on these frames. Mounting pads are easily adjusted to the mounting holes in the pillow block. One pad is moved by an adjusting screw, while the other pad slides freely to the proper distance between the pillow-block mounting holes.

Circle 650 on Readers' Service Card

Intru-lok Tube Fitting

Intru-lok tube fitting with modification in design that represents a major improvement announced by Parker Fittings & Hose Division of Parker-Hannifin Corporation, Cleveland, Ohio. Intru-lok is a "bite" type fitting consisting of body, nut, and ferrule. It is especially suitable for instrumentation, pilot, air, water, lubricant, or coolant lines of copper, aluminum, Parker-POL, or other plastic tubing. The modification involves the ferrule and nut. By



elongation of the ferrule and ingenious dimpling, it has become a "snap-in" ferrule, held "captive" by the nut. It can be pushed in or out with the fingers, but otherwise it will not drop out to become lost. This is a feature that appeals immediately to anybody who has worked with small tube fittings of three- or four-part construction.

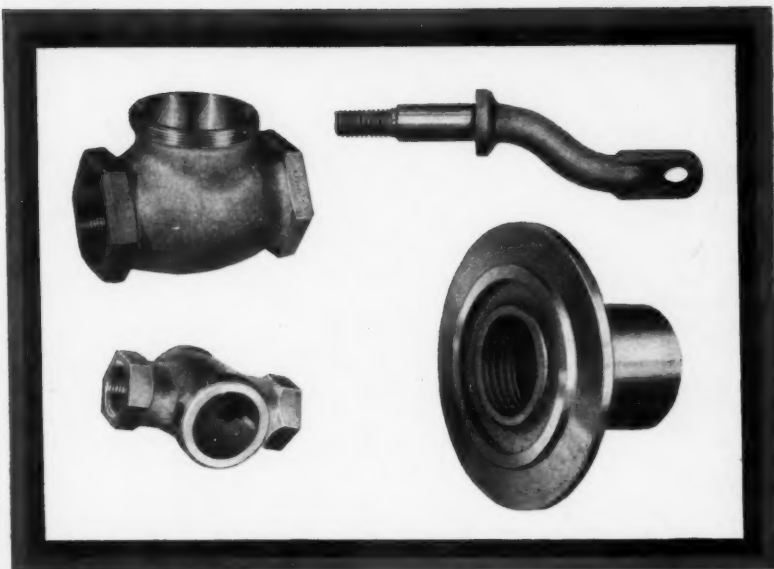
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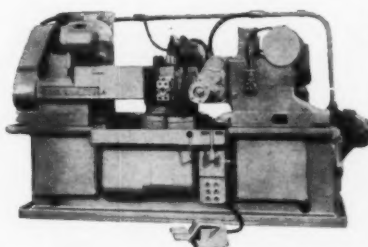
Micrometer Designed for Quick, Accurate Measurements

Extremely fast, quick-acting, easily read dial micrometer designed for measuring moving materials and other applications where quick, accurate measurements are imperative, introduced by the J. T. Slocomb Co., South Glastonbury, Conn. This micrometer is ideal for use in rolling mills, for gaging sheet-stock thickness while the mill is in operation, and for other manufacturing situations where the part to be measured is in movement and the time allowed for measurement is limited. It can be efficiently utilized by personnel who are not machinists or skilled in the use of conventional, difficult-to-read micrometers. One full turn of the micrometer's spindle covers the entire 0.250-inch operating range. Thickness is quickly read on the large, highly legible dial. It is available with standard 0.270-inch diameter terminals or with large 3/4-inch diameter terminals for measuring soft materials. If desired, it can be obtained with friction thimble and is available on order in larger sizes.

Circle 652 on Readers' Service Card



PLAN PRODUCTION OF PARTS LIKE THESE and MANY OTHERS . . . for speed, convenience and economy on GOSS & DeLEEUEW AUTOMATIC CHUCKERS

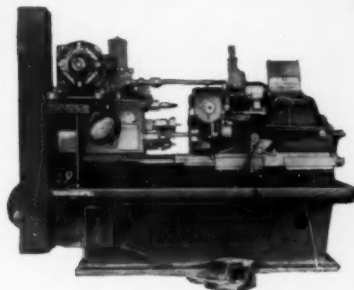


4-SPINDLE TOOL ROTATING CHUCKING MACHINES

available in three sizes, combine various turning, boring, facing, threading, multiple drilling and tapping operations on a wide range of single-ended parts.

The "ONE-TWO-THREE" 7-Spindle TOOL ROTATING CHUCKING MACHINE

can complete in one operation as many as three ends of valve bodies, plumbing fittings, etc. eliminating secondary operations.



Send samples of your work for time estimates. Ask for illustrated literature.

GOSS and DeLEEUEW

MACHINE COMPANY, KENSINGTON, CONN., U.S.A.



California and Oregon

ANTTII P. RAIHA has been appointed chief engineer of **BURGMAS-TER CORPORATION**, Gardena, Calif. A graduate mechanical engineer of



Antti P. Raiha, chief engineer, Burgmaster Corporation

Finland Institute of Technology, Mr. Raiha is internationally known in the field of machine tool design and has held key engineering positions with manufacturers in Europe, Canada, and the United States.

PARKER-HANNIFIN CORPORATION, Cleveland, Ohio, has announced the relocation of its industrial-components sales office for the southwestern region to new quarters at 10567 Jefferson Blvd., Culver City, Calif. Regional manager in this office is **D. G. HENDERSON**. Sales engineers include **DALE R. THOMPSON**, **FRANK W. COWDREY**, and **C. Q. HAGERTY**.

ROLLED ALLOYS, INC., Detroit, Mich., has opened a distribution center at 14044 Rosecrans, Santa Fe Springs, Los Angeles, Calif. **JOHN HOWELL** will be manager of the new center.

HYSTER Co., Portland, Ore., has elected **GLENN HERZ** and **JAMES L. WOODLEY**, vice-presidents. Mr. Herz, who is a veteran of fifteen years'

service with the company, was named vice-president—engineering. Mr. Woodley, who joined Hyster in 1945, became vice-president—manufacturing.

Illinois and Ohio

FANSTEEL METALLURGICAL CORPORATION, North Chicago, Ill., has appointed **LEONARD K. ADAMS** director of export activities. Mr. Adams will continue to represent all Fansteel divisions in the field of export sales, and will also be responsible for special studies and projects in the foreign field. Fansteel has also announced that it has contracted to acquire **WESSON TOOL Co.**, Detroit, Mich. The Wesson complex includes **WESSON MULTICUT CORPORATION**; **WESSON METAL CORPORATION**, including **ARCHER & SMITH DIVISION**; and **WESSON Co.** as subsidiaries. In addition, Fansteel is acquiring the controlling stock interest in the Canadian subsidiary, **WESSON CUTTING TOOLS, LIMITED**. Fansteel expects to retain Wesson management personnel, the general policies of the company and the locations of the facilities, which will be consolidated into a newly formed subsidiary, **WESSON CORPORATION**. **GEORGE T. BRENNAN** will be a director as well as the executive vice-president and chief operating executive of the company. **WILBERT B. DUNCAN** will be a director and senior vice-president, with **JAMES A. FRASER**, **MANUAL F. DIAZ**, **RAY W. RUCKEL**, and **LAWRENCE K. VRY** appointed as vice-presidents, respectively, of the Wesson Metal Corporation, Wesson Tool, Wesson Co., and the Archer & Smith Division. **BOB WAGNER**, also appointed a vice-president, will continue to function as Cleveland district manager. **EUGENE W. RYAN** will fill the position of secretary and treasurer.

The appointment of **WILLIAM F. BOHANNAN** as manager of the Marysville, Ohio, plant has been announced by **DENISON ENGINEERING DIVISION**, **AMERICAN BRAKE SHOE Co.**, Columbus, Ohio. In his new position, Mr. Bohannon will be responsible for all



William F. Bohannon, manager—Marysville, Ohio, plant, Denison Engineering Division

operations of the new Denison plant, which will be engaged in the production of hydraulic axial piston pumps and valves. Full-scale production is expected to be reached the latter part of 1961.

E. W. WAGNER has been named vice-president and general manager of **SIDNEY MACHINE TOOL Co.**, Sidney, Ohio. Mr. Wagner was formerly general sales manager.



E. W. Wagner, new vice-president and general manager of Sidney Machine Tool Co.

IF COMPETITORS MATCH YOU IN PRICE AND QUALITY...

the **LOCTITE** method can give you a double edge

The LOCTITE Method is a bold new approach in metalworking assembly. It reduces rejects, machining time, assembly failure, customer complaints . . . saves on parts and inventory.

Here's what it does: LOCTITE Sealant improves the reliability of press fits and increases their strength—replaces all sizes of lock nuts, screws and washers, jam nuts and interference threads—secures screws and locks studs—seals joints against high-pressure fluids—holds gears, rotors, armatures and fans to shafts.

And it does this without a penny invested in equipment. LOCTITE Sealant is simple to use. It can be applied to assembled parts or applied to parts prior to assembly. The plastic container is the applicator. Where desirable, automatic or mass application procedures can easily be set up with "around-the-shop" parts and materials.

What is LOCTITE: LOCTITE Sealant is a penetrating liquid resin that hardens when confined between closely fitted metal parts. It "wicks in" between the most closely mated of matched precision surfaces and hardens into a

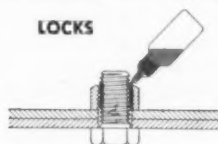
strong, heat-, oil-, grease-, solvent- and vibration-resistant bond. There are no solvents to evaporate—no catalyst to mix.

Want to reduce costs of your production assemblies?

Press fits depend on costly precise tolerances . . . the LOCTITE Method does not. LOCTITE makes a slip fit as strong as a press fit and a press fit still stronger. Thus it can be used to relax tolerances and to improve reliability. Here's one example: An anti-friction bearing with a press fit required 6,000 lbs. to remove it from its housing, while with a slip-fit and the application of a few drops of LOCTITE it took 8,000 lbs. to remove the same bearing!

Wherever metals are LOCKED—RETAINED—SEALED in your production assemblies, there is an opportunity to cut costs and realize better profits with the LOCTITE Sealant Method. Details on your application bring immediate response from our Application Engineering Dept. Write today.

LOCTITE GIVES YOU A DOUBLE EDGE— PRODUCTION ASSEMBLY SAVINGS AND GREATER RELIABILITY.



LOCKS



RETAINS



SEALS

LOCTITE[®] SEALANT

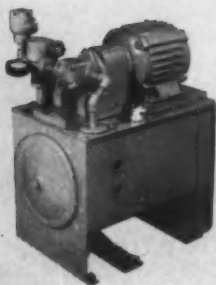
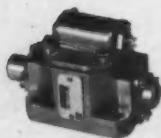
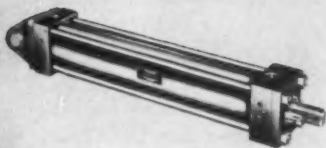
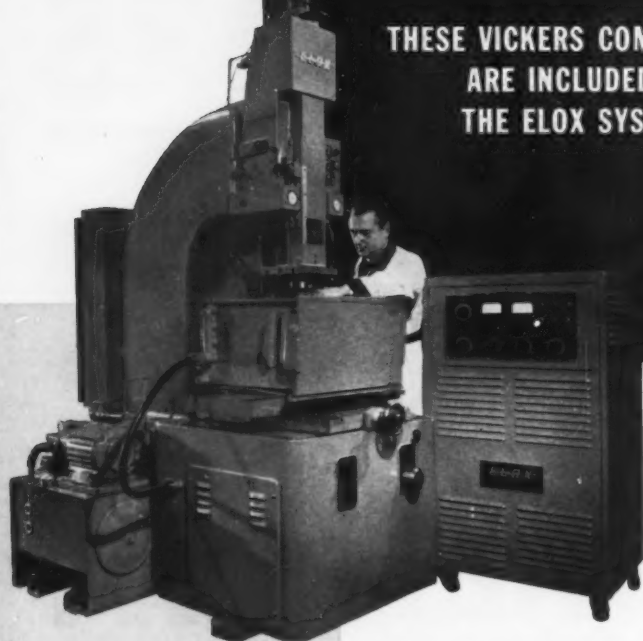
MACHINERY, May, 1961

American Sealants Company • 207 North Mountain Road
Hartford 11, Connecticut

For more data circle this page number on card at back of book

231

THESE VICKERS COMPONENTS ARE INCLUDED IN THE ELOX SYSTEM



HYDRAULIC CYLINDERS—Low frictional drag and dependable operation of the 3-inch bore, 12-inch stroke cylinders makes them ideal for the Elox machine shown. Vickers builds a complete line of cylinders and offers a wide choice of mounting options, rod end threads, wrench flats, port positions and connections. Standard bore sizes range from 1½" to 8" with either standard or heavy duty rods; special designs can be provided to suit every application. For more details ask for Bulletin 60-68.

SERVO VALVES—Extremely critical requirements for low deadband and high response for instantaneous reversals to clear the electrode dictated the selection of a Vickers servo valve for the Elox spark discharge machine. Three series of Vickers servo valves are available to meet every type of industrial application: a single stage valve rated at 0-3 gpm and two series of 2-stage servo valves for flows of 0-17 gpm and 0-37 gpm. For more details ask for Bulletins 59-74, 61-79.

POWER PACKAGE—The standard Vickers T-10 power package supplies the steady pressure required for optimum operation of the Elox electrical discharge machine. A vane pump and relief valve matched to the system plus the basic tank unit constitute the power package. Vickers builds the most complete range of power packages available anywhere—all components "matched" in output to insure optimum performance and reliability. For more data on how these power packages can simplify your design and procurement problems, contact your Vickers Application Engineer.

VICKERS

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1403 • Detroit 32, Michigan

Don't Miss Booth 549
Design Engineering Show
Detroit, May 22-25

R. K. LeBLOND MACHINE TOOL Co., Cincinnati, Ohio, has appointed D. M. DUNCAN MACHINERY Co., LTD., Windsor, Ontario, Canada, a dealer to sell LeBlond lathes in Ontario and Quebec. The company has also made a change in the Jacksonville, Fla., distributorship. The Jacksonville area will now be serviced by J. R. CARLSON MACHINERY Co., Atlanta, Ga.

PARKER-HANNIFIN CORPORATION, Cleveland, Ohio, has added FRED D. ZIKAS to the Detroit, Mich., sales office and DENNIS SULLIVAN to the Chicago, Ill., office. Also, JOHN W. CHAMBERLAIN, joining the Cleveland office, has been assigned to work in the Toledo, Ohio, area.

Michigan and Wisconsin

MICROMATIC HONE CORPORATION, Detroit, Mich., announced the appointment of JOSEPH L. PULLIAM as sales manager of the MICRO-PRECISION DIVISION, Los Angeles, Calif., and THOMAS J. CHADWELL, assistant to the director of marketing, to succeed Mr. Pulliam as sales manager of the company's Microhoning products. Mr. Pulliam was appointed to his new post to establish experienced leadership in selling self-lubricating Fabroid bearings. Mr. Chadwell has over fifteen years' training and experience in selling and servicing the products he will now represent as sales manager.

OHIO FORGE & MACHINE CORPORATION, Cleveland, Ohio, has announced its acquisition of the entire outstanding shares of PRECISION COLD FORGED PRODUCTS Co., Detroit, Mich., through an exchange of stock. Newly elected as chairman of Precision Cold Forged Products Co. is E. P. PRESCOTT. Other new officers are CHARLES E. THAYER, as president; C. E. HUDDLESTON, vice-president; and W. M. HUSBAND, secretary and treasurer.

JOHN W. GIVENS, office manager of the Detroit, Mich., sales district for LATROBE STEEL Co., Latrobe, Pa., has been assigned to the company's special products division as a sales representative in Detroit. Mr. Givens will service jobbers, dealers, and distributors with the Latrobe line of flat ground stock, tool bits, drill rod, and wear parts.

CHARLES E. HEITMAN, JR., has been elected a vice-president and a member of the administration committee for BENDIX CORPORATION, Detroit, Mich. Mr. Heitman will con-

MACHINERY, May, 1961



ROBERT WEBB, RESEARCH DIRECTOR, ELOX CORPORATION SAYS:

"Jointly developed hydraulic system provides fast response needed for spark machining..."

"When people have a problem that can be solved with three-dimensional electric discharge machining, they come to Elox for our special skills and knowledge. Similarly, we insure that our machines offer the last word in performance by working as a team with components and systems manufacturers.

"To produce cavity dies like the one shown above, we designed and built a machine with a precision table and a vertical slide accuracy that we can guarantee within .0005" to 12 inches. We were able to develop a hydraulic circuit for the vertical slide and get a faster response than with any other method because Vickers engineers understood our problems thoroughly and cooperated fully in effecting their solution.

"Speed of response is half the story; the other is precise maintenance of the spark gap without 'hunting'—enabling the spark machining operation to be completed in the shortest possible cycle. Our hydraulic package meets all the foregoing requirements because the indi-

vidual units are matched to each other and to the machine itself."

The Elox experience is typical of Vickers assistance to machinery builders and/or users in providing outstanding hydraulic equipment or systems to insure peak performance. Specialists working with the broadest line of top quality hydraulic components available anywhere give you a system ideally suited to your specific needs. See facing page for more details about the hydraulic components used by Elox and the entire Vickers line.

VICKERS®

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

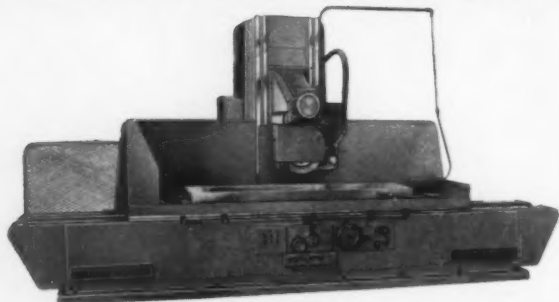
Machinery Hydraulics Division

ADMINISTRATIVE and ENGINEERING CENTER

Department 1403 • Detroit 32, Michigan

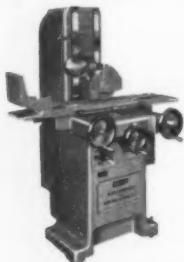
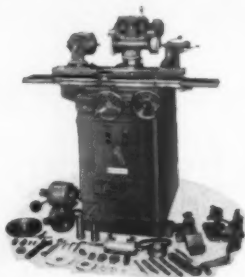
FOR

MAXIMUM PRECISION IN TOOLROOM OR PRODUCTION GRINDING



MODEL F HYDRAULIC FEED SURFACE GRINDER a production type with cross sliding head, built in sizes ranging from 12" x 18" x 48" to 30" x 25" x 120". Heavy, powerful grinder with maximum table speed of 150' per minute. Motor mounted directly on grinding wheel spindle to assure full power is transmitted directly to wheel. Automatic feeds in increments from .0001" to .001" per reversal available.

NO. 10 UNIVERSAL CUTTER AND TOOL GRINDER built to meet the need for a high grade machine of medium capacity at a moderate price. Combines rigidity with maximum convenience of operation. Head swivels 360°, locks in any setting; table swivels 90°. Hand operated longitudinal movement. Two spindle speeds.



NO. 20 HAND FEED SURFACE GRINDER has hand wheels for vertical and longitudinal table movement to assure toolroom precision and exceptionally fine finish. One-piece column and base, greased-for-life ball bearing spindle. Available with portable, motor driven coolant system.

tinue to serve as the group executive in charge of the Bendix products division, South Bend, Ind., and SHEFFIELD CORPORATION, a subsidiary of Bendix, as well as Sheffield's associated companies.

Appointment of CENTRAL INDUSTRIAL SUPPLY Co., Grand Rapids, Mich., as a distributor for Parker industrial tube fittings; Hannifin pneumatic and hydraulic cylinders and air control valves; and Crown air system regulators, filters, and lubricators was announced by PARKER-HANNIFIN CORPORATION, Cleveland, Ohio.

HOOVER BALL & BEARING Co., Ann Arbor, Mich., has named ROBERT B. PARKER director of materials and GERALD A. GRAHAM production control manager. Mr. Parker will fill a vacancy left by JAMES VERAS, who has been assigned responsibilities at another Hoover division.

The appointment of GRAY EQUIPMENT Co., Dearborn, Mich., as exclusive representative for ACF-Ero machine tools in the lower Michigan peninsula and the state of Ohio has been announced by the electronics division of ACF INDUSTRIES, INC., Riverdale, Md.

GISHOLT MACHINE Co., Madison, Wis., has announced the appoint-



Robert H. Presnall, general sales manager, Gisholt Machine Co.

GRAND RAPIDS

ment of ROBERT H. PRESNALL as general sales manager. He succeeds ROBERT H. BRUCE, vice-president in charge of sales, who will retire in June. Mr. Presnall joined Gisholt in 1944 as a special tool designer.

ERNST WIEDMANN has been elevated to vice-president and director of engineering by OILGEAR Co., Milwaukee, Wis. Mr. Wiedmann, who was born in Germany, joined Oilgear



Ernst Wiedmann, newly appointed vice-president and director of engineering, Oilgear Co.

in 1926, when the company and fluid-power industry were still in the pioneering stage. Prior to his present appointment, he served as chief engineer for a period of twenty-five years.

New England

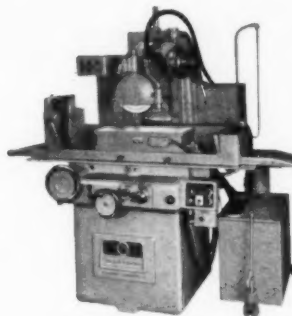
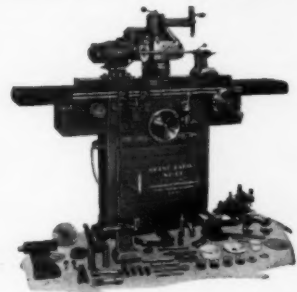
The transfer of HERBERT W. HECKENDORF to the research, engineering, and service staff has been announced by ELDORADO TOOL & MFG. CORPORATION, Milford, Conn. For the past four years, Mr. Heckendorf has served as Eldorado's mid-west sales and service supervisor.

WINCHESTER-WESTERN DIVISION, OLIN MATHIESON CHEMICAL CORPORATION, New Haven, Conn., has ap-

YOU

CAN FIND THE RIGHT MACHINE FOR YOUR NEEDS ON THESE PAGES

NO. 60 UNIVERSAL CUTTER AND TOOL GRINDER offers precision sharpening, fast set-ups and low maintenance. Designed for maximum convenience of operation, with work weight carried directly over base, permitting operator to stand close to work. Master hand wheel provides three speeds of longitudinal table travel.



NO. 1230 HYDRAULIC FEED O.D. & I.D. GRINDER meets the needs of users requiring a machine that does both internal and cylindrical grinding. It is a rugged, precision tool capable of taking rough cuts as well as producing the finest finish. Has a host of controls and adjustments for maximum convenience and versatility of operation.

A note on your letterhead will bring full details. Please specify the type of grinder you are most interested in.

NO. 360 HYDRAULIC FEED SURFACE GRINDER. A precision toolroom type which offers absolute accuracy with micro-inch finish at production speeds. One-piece column and base, infinite longitudinal table speeds from 3" to 120' per minute, variable speed cross feed. Available with new incrematic downfeed with automatic spark-out after pre-set stock removal.



GALLMEYER & LIVINGSTON CO., 305 Straight Ave., S.W., Grand Rapids, Mich.

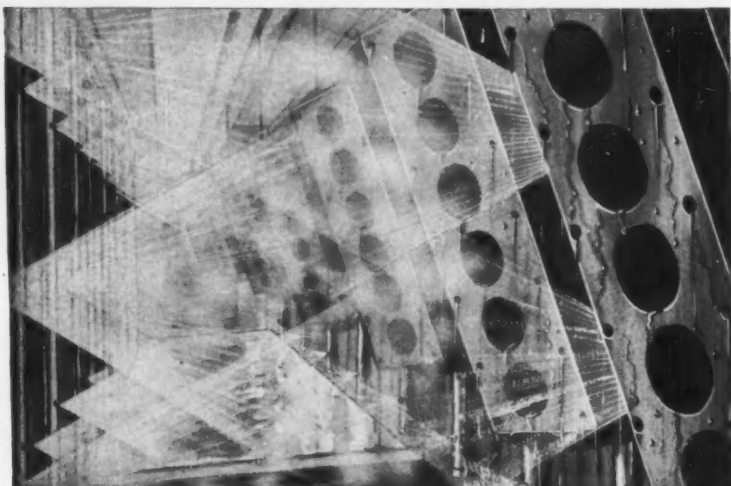
GRINDERS

**GALLMEYER
& LIVINGSTON**

To get more from your spray washer

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



New Oakite 198 sprays off soils fast . . . protects in-process parts from rust

Users tell us that nothing equals Oakite 198 for cleaning parts in-process. Here's why they think so:

- It clears off heaviest soils at temperatures up to 180° F, and light soils at room temperature.
- Metal chips wash away under its action.
- When dry it leaves a protective film that prevents the rusting of machined or ground parts prior to assembly—yet it doesn't affect accurate gauging.

Now largely used in automotive plants, Oakite 198 is proving its economy as well as its unique effectiveness in providing fast, smut-free cleaning plus rust protection. It works in single or multistage machines, at economical concentrations.

Oakite 198 is just one of a complete line of Oakite materials for machine cleaning. There are non-foaming solvent agents for heaviest duty cleaning, alkaline cleaners for removing moderate to light soils. When you ask Oakite you can be sure of getting a cleaning compound designed to give you best possible results, designed to reduce your "per unit" cost. You can be sure, too, of getting prompt, intelligent in-plant service from your local Oakite man.

Send for Bulletin. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite



pointed ELBERT R. FAUST plant manager and F. MORGAN TAYLOR, JR., marketing manager of RAMSET FASTENING SYSTEM, New Haven. Mr. Faust has had more than fifteen years' experience in the fastening field. Mr. Taylor had been Ramset plant manager since 1958.

J. DAVIDGE WARFIELD was named vice-president-sales of VEEDER-ROOT INC., Hartford, Conn. Mr.



© John Haley

J. Davidge Warfield, vice-president-sales, Veeder-Root Inc.

Warfield had been manager of marketing for the company since 1960. He had previously been with H. K. PORTER CO.

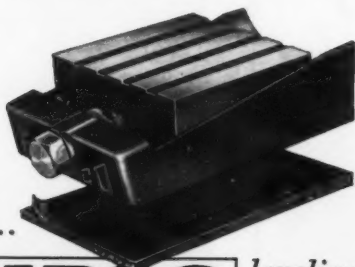
BROWN & SHARPE MFG. CO., Providence, R. I., has announced four new appointments. EDWARD KIBBITT has been named supervisor of subsidiary operations, in which capacity he will be in charge of cutter shop



Edward Kibbitt, newly appointed supervisor of subsidiary operations, Brown & Sharpe Mfg. Co.

DEPENDABLE MACHINE SUPPORT ... PRECISION LEVELING

get
both
with...



EMPCO leveling
jacks

Solid, easily adjustable foundation for machine tools, large surface plates, automation lines, tool room and production equipment of all types. Easily installed, they increase machine efficiency, reduce downtime and maintenance. Combined with Vi-Sorb Mounting pads, Empco Jacks reduce objectionable vibration to a minimum, retard creepage, often eliminate the need for anchor bolts. Built to take it, Vi-Sorb pads stand up under repeated impact . . . resist oils, greases, acids. Jacks available in 6 styles, 25 models. Pads to fit.

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2727 JEROME AVE. • DETROIT 12, MICH.

Manufacturers of Automatic Production Machines, Fixtures, Machine Parts

For more data circle Item 237A



ALVA ALLEN

Heavy Duty PUNCH PRESSES

Model BT-8
8 Ton
\$289.50
less motor—fab

Model BT-25
25 Ton—\$1097.50
less motor—fab

Model BT-5
5 Ton
\$109.50
less motor—fab

**Powerful
Dependable and Economical
Fully Guaranteed**

Model BT-12
12 Ton
\$437.50
less motor—fab

Model B-2-2-Ton
\$307.50
less motor—fab

See your Supply Dealer or write for Catalog giving complete information, specifications and prices on our line of Heavy Duty Punch Presses.

Hundreds of different Model Combinations 1 to 25 ton Capacities

See the yellow pages of your telephone directory for local distributor.

Thousands in use the World over

ALVA ALLEN INDUSTRIES, Dept. M
CLINTON, MISSOURI • Telephone TUrner 5-3331

For more data circle Item 237B

MACHINERY, May, 1961

CUT
CUT
CUT

**BIG!
FAST!
SMOOTH!**

New "No. 20" Speed & Cut

OSCILLATOR

THE ANSWER TO YOUR
"TOUGH STUFF TO CUT"
PROBLEMS

CUTS
LARGER
SOLIDS



Available on
leasing or extended
payment plan.

IT OSCILLATES
WHILE IT CUTS

LEAVES "MACHINE
TOOL" FINISH

Speed & Cut

Abrasive Cutting Machines
MANUAL OR POWER-OPERATED MODELS
FOR WET, DRY OR ANY-ANGLE CUTTING!

Speed & Cut

Send for complete
catalog and name
of nearest distributor

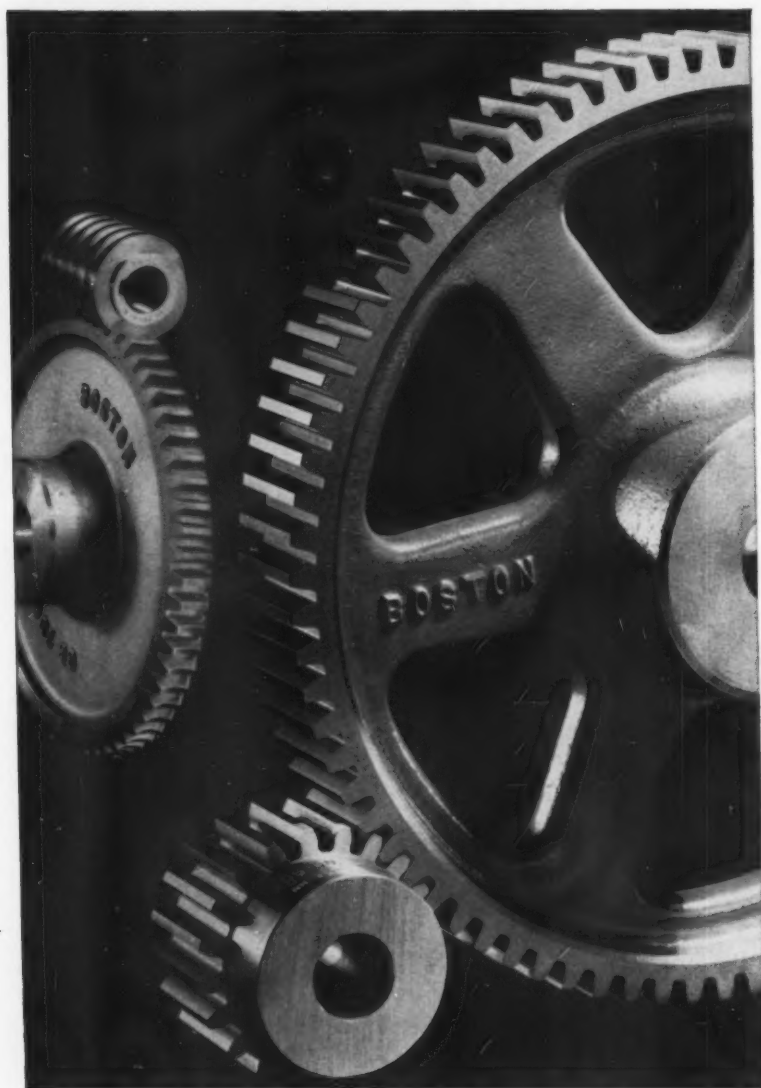
**ABRASIVE MACHINE DIV.
BEAVER PIPE TOOLS, INC.**

DANA AVE.
WARREN, OHIO

For more data circle Item 237C

BOSTON[®] Gear QUALITY

14½° stock gears 20°



Largest selection - off the shelf.

1781 types and sizes 14½° P.A. - 48 to 3 pitch.

782 types and sizes 20° P.A. - 120 to 4 pitch.

Spur, bevel, miter, worm, helical, spiral miter.

Brass, steel, iron, nonmetallic. See Catalog 57.

IN STOCK at your nearby DISTRIBUTOR

BOSTON[®] Gear

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Quincy 71, Mass.



Frank E. Montie, factory manager of the Greystone plant, Brown & Sharpe Mfg. Co.



T. Russell Hall, new plant superintendent, Greystone plant, Brown & Sharpe Mfg. Co.

operations, sales, engineering, and management coordination. HENRY A. SZOSTEK will be manager, eastern sales district, and will now combine the north-central and East Coast areas into one sales district. FRANK E. MONTIE has become factory manager, Greystone plant, and will be in charge of actual manufacturing operations in the cutting tool division. T. RUSSELL HALL will assume Mr. Montie's duties as plant superintendent, Greystone plant.

TAFT-PEIRCE MFG. Co., Woonsocket, R. I., has announced the appointment of three new vice-presidents; FRANKLIN MEYER, JR., engineering; KENNETH H. WILLIAMSON, manufacturing; and JOHN G. ZEIGER, marketing. In addition, DR. WALTER M. SAUNDERS, JR., has been made a metallurgical director.

New York and New Jersey

VIKING TOOL & STEEL CO., INC., Buffalo, N. Y., has been appointed by METAL CARBIDES CORPORATION, Youngstown, Ohio, as its sales agent in western New York State. Viking will handle the sales and service of Metal Carbides' line of tungsten-carbide tools, dies, blades, rolls, bushings, special metals, and diamond products marketed under the trade name of Talide.

RIVERSIDE-ALLOY METAL DIVISION, H. K. PORTER CO., INC., Riverside, N. J., has announced the location of a sales office in Cincinnati, Ohio, and the relocation of its Chicago, Ill., district office. The new Cincinnati office will be located at 3537 Epley Road and will be headed by JOSEPH WHINNEY. The new address for the Chicago office will be 2567 Greenleaf Ave., Elk Grove, Ill. It will be under the direction of JOSEPH A. DAVIS, district manager.

WILLIAM T. NYSTROM has been made field sales manager of ADAMAS CARBIDE CORPORATION, Kenilworth, N. J. He will be responsible for supervision of the Adamas field sales force.

Pennsylvania

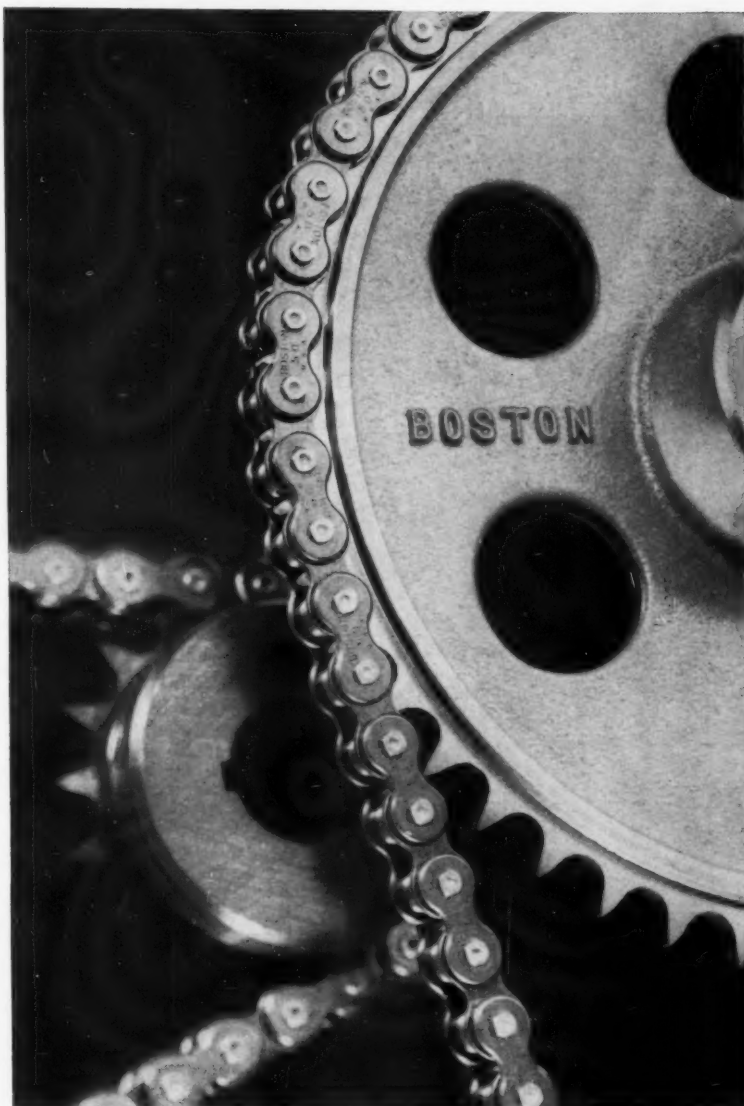
ROBERT M. SIMPSON has been appointed assistant director of sales for CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa. In his new position, Mr. Simpson will assist in the direction of all sales activity of the company and will act as second in command to JOSEF H. BUERGER, JR., Crucible's director of sales. His work will include supervision of both field sales, through the thirty-eight branch warehouses and sales offices, and the sales managers of product divisions.

CHARLES W. ROSNER, a field sales engineer for BENDIX CORPORATION, Industrial Controls Section, Detroit, Mich., will represent the Bendix line of numerical-control systems for machine tools in an area centered around Philadelphia, Pa. He will report to the Bendix regional office in West Hartford, Conn.

EDMUND M. VELTEN has been promoted to the position of vice-president, production, of BERYLIUM CORPORATION, Reading, Pa. Mr. Velten, in his new capacity, will be responsible for production operations at the company's alloy division in Reading and the nuclear division at Hazelton.

STUART POLITO has been appointed sales engineer for the Pitts-

BOSTON *gear*® QUALITY sprockets and chain



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1488 types and sizes. From local stock.

Off the shelf - at factory prices.

For any chain drive 1/4" to 2" pitch -
Roller, Block, Ladder. See Catalog 57.

Design around the quality leader.

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HAS OVER 1001
GUN DRILLS IN STOCK



NOW AVAILABLE FROM STOCK ALL SOLID CARBIDE TIPPED Dias. in every 1/64" increment		
Size-Dia.	Length	Driver
.1250" to .5000"	10", 16", 22"—all dias. 28", 36"—most dias.	3/4" x 2 3/4"
.5156" to .7500"	16", 22", 36"	1" x 2 3/4"
.7656" to 1.0000"	22", 36"	1 1/4" x 2 3/4"
IMMEDIATE SHIPMENT		
Also custom made Gun Drills in all dias. up to 2" in any length within dia. limits —ON NORMAL DELIVERY		

...there's ONE to LOWER YOUR HOLE COSTS!

ELDORADO'S constant inventory of popular size GUN DRILLS is keyed to the needs of the industry, designed to the most exacting specifications! Made to produce economically, straight, round, accurately located, finely finished holes... FASTER, In One Single Operation.

Our years of accumulated GUN DRILL making experience and knowledge, plus a complete research and engineering department are yours to take advantage of.

Get these important benefits with ELDORADO

- The world's largest manufacturer of GUN DRILLS—exclusively.
- A complete choice of sizes, lengths, types.
- Eliminate secondary operations—reaming, honing, grinding.
- Save your company money by reducing "cost-per-hole."
- Drill most materials—aluminum, cast iron, brass, tool steel, stainless, etc.
- Drill any shaped part to any depth (sometimes interrupted holes or across existing holes).
- Drill shallow or deep holes to precision tolerances.

Since these extras cost you no more...
your best bet is an ELDORADO GUN DRILL

ELDORADO specialized engineers, backed by research facilities are available to assist you on special 'HOLE' problems. WRITE TODAY!

Specializing 100% in Gun Drills and Related Tools.



ELDORADO TOOL & mfg. corp.

348 BOSTON POST ROAD • MILFORD, CONN.

burgh, Pa., area by CAPEWELL MFG. Co., Hartford, Conn. Mr. Polito will represent the company with a complete line of hand, power, and band saws, as well as other machinists' tools.

ROBERT C. TYO has been made vice-president, DeWalt operations, by BLACK & DECKER MFG. Co., Towson, Md. Mr. Tyo was recently elected to the presidency of DEWALT, INC., Lancaster, Pa., a Black & Decker subsidiary.

The appointment of JONATHAN SMITH as vice-president of sales has been announced by SUNBEAM EQUIPMENT CORPORATION, Meadville, Pa. Mr. Smith was formerly project manager.

Texas and Arkansas

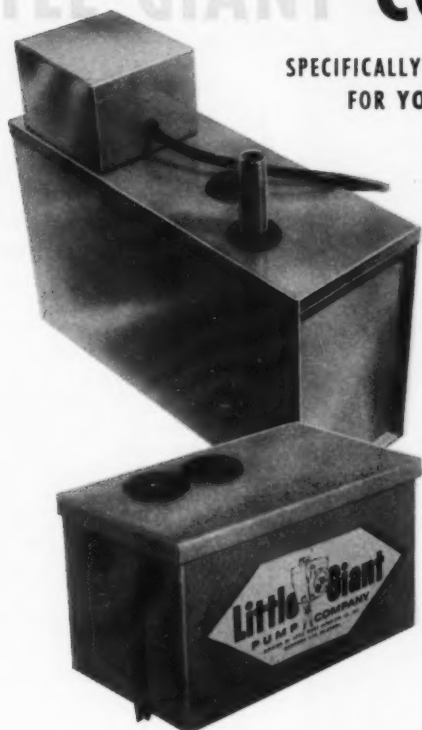
MAURY SEELEY has been appointed west south-central sales representative of MORSE TWIST DRILL & MACHINE Co., New Bedford, Mass. Mr. Seeley, who has been with Morse since 1957 as a salesman in the San Diego, Calif., area, will be assigned to the company's Houston, Tex., office.

MARSHALL SUPPLY & EQUIPMENT Co., Fort Smith, Ark., has been appointed an authorized distributor branch office for Carboly cemented-carbide products, according to an announcement by METALLURGICAL PRODUCTS DEPARTMENT, GENERAL ELECTRIC Co., Detroit, Mich. Marshall's territory will include counties of Benton, Washington, Crawford, Sebastian, Scott, Polk, Carroll, Madison, Franklin, Logan, Montgomery, Boone, Newton, Johnson, Yell, and Pope in Arkansas.

Germany

ROSS OPERATING VALVE Co., Detroit, Mich., has organized a new sales and distributing network to cover the majority of Europe. The center of the organization for Europe proper will be Ross EUROPA of Frankfurt/Main, Germany. That facility will function as central European factory representative and as marketing manager for representatives in a dozen other nations. Although maintenance of an inventory for Europe in general will not be a primary function, the organization in Frankfurt/Main will carry enough stock to replenish specific items needed quickly by stocking representatives in such nations as Bel-

LITTLE GIANT CONDENSATE UNITS



**SPECIFICALLY DESIGNED
FOR YOUR NEEDS**

Little Giant condensate units are especially designed to fit any mechanical refrigeration or air conditioning unit for condensation removal. Available with positive displacement double pole switch, depending on model. Sturdy metal tanks resist corrosion. Available for 115V, 60 cycle or 230V single phase.

For complete specifications, contact:



DIVISION OF LITTLE GIANT CORPORATION
3810 N. Tulsa • Oklahoma City, Okla.

For more data circle Item 241A

**DYKEM
STEEL BLUE**

**Stops Losses
making Dies and
Templates**

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench: metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303R North 11th St. • St. Louis 6, Mo.

CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2303R NORTH 11TH ST., ST. LOUIS 6, MO.

For more data circle Item 241B

GEARS—ALL MAKES . . .
Special and standard
PRECISION GEARS UP TO 200 DIAMETRAL PITCH
All Gears certified for Accuracy
Quality and Fine Workmanship

NEW JERSEY GEAR & MFG. CO.
1470 Chestnut Ave. Hillside, N. J.

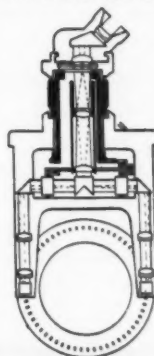
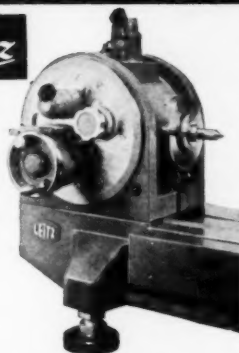
For more data circle Item 241C

MACHINERY, May, 1961

ULTRA PRECISION IN SPACE

Leitz

Ultra Precision Spacing on guided missile components and similar critical work guaranteed by this exclusive DOUBLE-MICROSCOPIC PICK-UP of the LEITZ OPTICAL MASTER DIVIDING HEAD.



It compensates for run-out, the most common source of error. Working accuracy ± 1 second of arc.

There is no substitute for LEITZ in optical dividing.

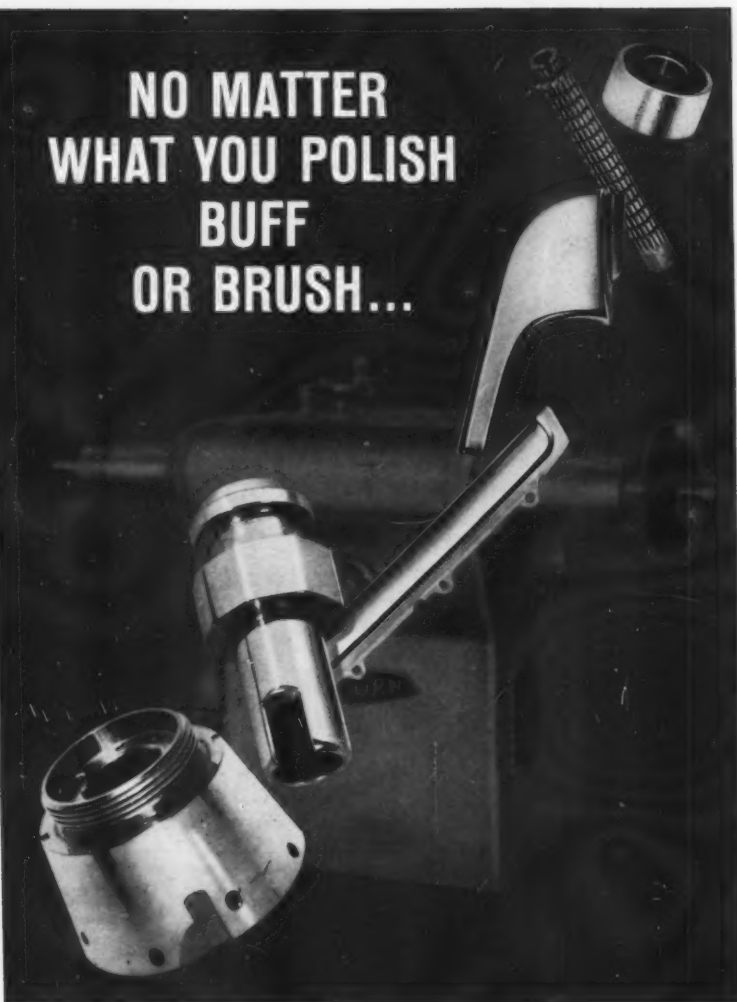
Request catalog 82-1

OPTO-METRIC TOOLS, INC.

137-M VARICK STREET, NEW YORK 13, N. Y.

For more data circle Item 241D

**NO MATTER
WHAT YOU POLISH
BUFF
OR BRUSH...**



NEW OSBORN POLISHING/BUFFING LATHES ... these compact, variable speed lathes are Osborn-engineered to handle your work economically at highest efficiency. Available with balanced single or double spindles, fixed or variable speed ranges from 600 to 3600 rpm. Variable speed lathes have 3-to-1 speed range. Choice of 3, 5 or 7½ hp motors. Other features include: motor-mounted magnetic disc brakes for instantaneous spindle stopping. Roto-Cone drive for instant, vibration-free power transmission and speed changes.



FREE BULLETIN 620 includes complete specifications, operating and construction details plus application data. For your copy, write or call The Osborn Manufacturing Company, Dept. D-64, Cleveland 14, Ohio. Phone ENdicott 1-1900.



Booth 2407



Metal Finishing Machines...and Methods • Industrial Brushes • Foundry Production Machinery

gium, Denmark, Norway, Switzerland, and others. All stocking representatives normally will get their regular stock either from Ross Operating Valve Co. in Detroit or its English licensee, WELLMAN SMITH OWEN CORPORATION, London, England.

Arc-Welded Design is Subject of Award Program

A \$25,000 award program for progress in arc-welded design has been announced by the James F. Lincoln Arc Welding Foundation. Cash awards are offered for papers describing the welded-steel design of either machines or structures. Competition is open to any United States resident who has taken part in the design, planning, or production of the design described in his paper.

Separate awards will be made for machines and structures. In the machine design competition, papers must present a discussion of the use of arc-welded steel in the design of either a complete machine or a machine component, including achieved or expected results relating to performance and/or appearance, in addition to savings in material, time, or money made possible through welded design.

Awards totaling \$12,500 will be made to the thirty-eight papers adjudged best in the mechanical division, and a similar amount will be awarded to a like number of papers in the structural design group. Complete rules and related information may be obtained from the James F. Lincoln Arc Welding Foundation, P. O. Box 3035, Cleveland 17, Ohio. The competition closes July 17, 1961.

Best Paper Award to Professor Enrick

Professor Norbert L. Enrick, University of Virginia, Charlottesville, received the Best Paper Award for 1960—at the Winston-Salem, N. C., meeting of the American Society for Quality Control—for his paper on "Variations Flow Analysis," which was published last August in the society's journal, *Technometrics*.

The technique of Variations Flow Analysis, developed by Mr. Enrick, is applicable to a wide range of industrial processes. The basic features of the system are also described in Chapter 18 of Mr. Enrick's book, *Quality Control*, fourth edition, 1960, published by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y.



Spur Gears and Pinions

Rigid inspection from first to last insures exact compliance with customer specifications. These 61.274" O.D., 5" F., 56.187" I.D., 108 T., 1 1/4" C.P. semi-steel ring spur gears and steel spur pinions—8.355" O.D., 5 1/2" F., 13 T., 1 1/4" C.P., are being given final checks before shipment. Accuracy and prompt delivery are bywords at Stahl Gear. Our estimate will convince you.

SPURS TO 72" P.D. 1 DP
BEVELS TO 54" P.D. 1 DP
SPIRAL, HELICAL and WORM GEARS
TO 48" P.D. 2 DP
CONTINUOUS TOOTH HERRINGBONE
TO 60" P.D. 2 DP
SPROCKETS TO 72" P.D. 2 1/2 CP
RACKS TO 20 FT. LONG. 3 DP
SILENT GEARS
RAWHIDE, BAKELITE, FIBROIL
HEAT TREATED, CASE OR FLAME
HARDENED GEARS—
OF CARBON OR ALLOY STEEL

Stahl
GEAR & MACHINE
COMPANY
3901 HAMILTON AVENUE
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For more data circle Item 243A

**B & R B
PRECISION BEARINGS**
are manufactured to advance standards in the paths of progress for uninterrupted service and offer greater durability. Our catalog #20 will guide your selection listing many standard sizes which can be supplied without any costly delays. May we be of service in supplying your requirements?

THE BALL & ROLLER BEARING CO.
DANBURY, CONN.

For more data circle Item 243B

Just **\$3.00** If YOU Bend or Cut Just **\$3.00**
think of how fast you could get \$3.00 back. That's what the 196 page (156 illustrations and charts) "A Manual of Processes for The Cold Bending of Metals and Abrasive Cut-Machining of Metals" costs.

Written for shop men by shop men.
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For more data circle Item 243C

CAMS
ALL TYPES
MADE TO
YOUR
SPECS!
EISLER ENGINEERING CO., INC.
Chas. Eisler, Jr., President
CAM CALCULATING
SERVICE
Write for
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738 South 13th Street
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For more data circle Item 243D

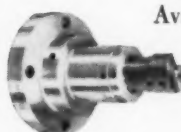
SPECIFY **BRINEY** PRECISION ADJUSTING TOOLS

**SPLIT-TENTH adjustments without
loosening or tightening screws**

- Pre-loaded bearings for rigidity
- Sealed for lifetime accuracy
- Increase production
- Reduce Scrap
- Eliminate secondary operations
- and many other features too numerous to mention

Precision Boring Quills

Available in stocked standards and specials for boring, turning, retracting, depth adjusting plus multiple adjustments.



Grinding Wheel Dresser Arm

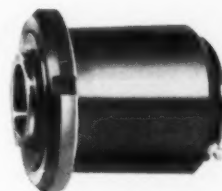
Another application of the Briney Principle for precision adjusting tools. The principle of this adjustment can be used for numerous other applications. Your inquiries are invited.

AND **BRINEY**

Anti-Friction Support and Pilot Bearings

NEW Briney milling machine support bearings have been re-designed for longer life and lower cost. **AVAILABLE FROM STOCK.**

Pilot and other special anti-friction bearings are designed to suit particular applications.



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For more data circle Item 243E

New Books and Publications

MACHINE-TOOL SLIDES AND SLIDING ELEMENTS. By H. W. Hardy. 76 pages; 6 by 9 inches. Published by the Machinery Publishing Co., Ltd. Available from THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, \$1.50.

This new addition to the British Yellowback Series (No. 47) describes a wide range of practical designs of slides and sliding elements for machine tools.

As slides of all descriptions play such an important part in the design and successful operation of most machine tools, and other machinery, it was thought that a book showing the various types of sliding elements, with their relevant descriptions, would be much appreciated by the student and junior engineer, and might also be of interest to the more experienced designer.

As there are so many different types of sliding elements and guide ways, and alternative designs for the majority of them, all dependent more

or less on the conditions under which they are to be used, it will be appreciated that only a very small percentage of them can be dealt with in a book of this size. However, if the reader will study these examples carefully and then endeavor to examine some actual machine tools which have the same, or similar, guide ways, then he should acquire a sound practical knowledge of this subject which will enable him to deal with any slide problem he may encounter.

METALS HANDBOOK, EIGHTH EDITION, VOLUME 1—PROPERTIES AND SELECTION OF METALS. 1300 pages; 8 1/4 by 10 7/8 inches; 6700 illustrations; 1841 tables. Published by the American Society for Metals, Metals Park, Novelt, Ohio. Price, \$30.

This first volume of a projected series of books which, when completed, will cover all branches of metals engineering and metalwork-

ing deals with the subjects of selection and properties of metals. Major sections of the book, in addition to tool materials, are: carbon and low-alloy steels; cast irons; stainless steels and heat-resisting alloys; non-ferrous metals; and magnetic, electrical, and other special-purpose materials.

Consisting of twenty-two articles, prepared by twenty committees of ASM, the tool material section includes 400 specific comparisons of tool wear, tool life, and tool economy in production. Coordinated with these extensive production data are seventy-one selection tables which recommend tool materials for 2300 applications of specific tools. The 248 contributors to this major section represent virtually all of the supplying and consuming industries. In addition to their main contributions on selection and application of tool material, these engineers and tool specialists from industry have included a great deal of valuable related information on tool design and operation.

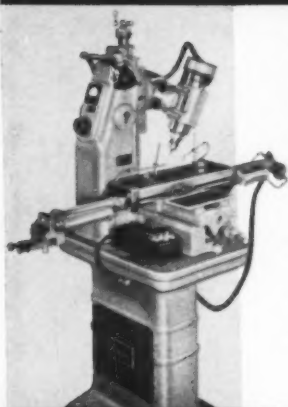
The tool materials section of the new handbook volume is a book within a book, containing 815 illustrations and 181 tables. (This

MILLS TO .0001" ...

Precise

finishes under 10 microinches!

PRECISE HIGH RPM MILLING MACHINES



Compact, universal production machine tools for high precision milling. Ideal for accurate production of sub-miniature, optical and instrument components as well as larger parts used in hydraulics, aircraft, missiles. Uses carbide midjet mills up to 3/4" diameter and grinding wheels up to 2" diameter. Precision Milling Machines are available in two models... with a power range from 1/2 hp to 2 hp, and an infinitely variable speed range from 7,200 to 54,000 rpm. Both models can be furnished with Precision Universal Power Quills or Super Cycle Power Quills.

Precise

Grinder-Millers, Power Quills, Jig Grinders, Milling Machines, Automatic Drill Units, Cutting Tools, Vapor-Lub Cooling, Sclero Hardness Tester. Quality and Precision Since 1882

PRECISE PRODUCTS CORPORATION

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Branch Plant: Precise, G.m.b.H., Duesseldorf, Germany

P105

For more data circle Item 244A

**VADEN
VANISOUL**



**New Epoch making Additive
in the preparation of Water-
Soluble Grinding Fluid.**

By adding 1% in volume of VADEN VANISOUL to water, a splendid grinding fluid, excellent both in anti-rust and machining capacities, will be produced.

This fluid guarantees the most precise and cleanest finish to the metal work surfaces, while improving the grinding efficiency.

(For further Technical Literature please apply to us)



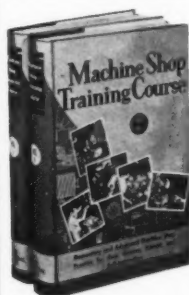
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30, 3-CHOME, IMAFUKU-NAKA, JOTO-KU, OSAKA, JAPAN
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For more data circle Item 244B

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for young man who has had experience in a machine shop or drafting department and has writing ability. Engineering degree preferable. State experience and salary. Location, New York City. Box 733, MACHINERY, 93 Worth St., New York 13, N.Y.



MACHINE SHOP TRAINING COURSE

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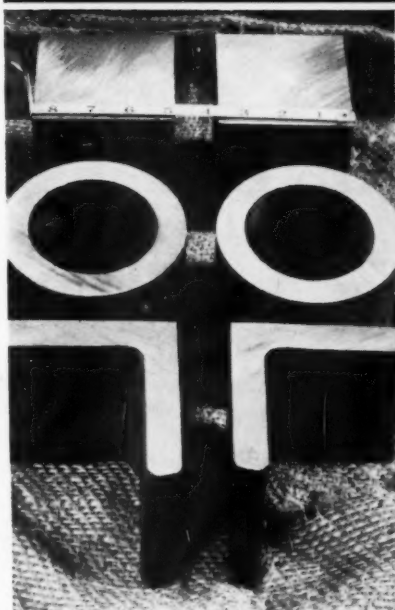
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may be compared with 22 illustrations and 28 tables in the corresponding subject matter of the previous seventh edition of the *Metals Handbook*.)

The types of tools covered by the individual articles in the new volume include: cutting tools; blanking and piercing dies; press-forming dies; deep-drawing dies; coining dies; cold-extrusion tools; cold-heading tools; thread-rolling dies; forging die-blocks and inserts; hot upset-forging tools; hot-extrusion tools; tools for drawing wire, bar, and tub-

ing; shear blades; rolls; permanent molds; die-casting dies; plastic molds; and gages. There are also summarizing articles on the properties and applications of tool steels, sintered carbides, and cast-cobalt-alloy tool materials.

Along with the tool material section, several other sections of the book will also be of direct interest to process engineers, production and planning supervisors, and metalworking management. For instance, a group of eight articles on the selection of steel for processing and

economy contains several hundred practical examples and comparisons prepared by 112 engineers from a variety of metalworking industries.

KEMPE'S ENGINEERS YEAR-BOOK FOR 1961, VOLUMES ONE AND TWO. Edited by C. E. Prockter under the direction of B. W. Pendred. 1324 and 1408 pages, respectively; 4 1/2 by 7 inches; illustrated. Published by Morgan Bros. Ltd., 28 Essex St., Strand, London, W. C. 2. Price (two volumes in case), 87s. 6d., plus postage.

Kempe's Engineers Year-Book for 1961 contains revised information in almost every one of its eighty-four sections. The chapter entitled *Motor Vehicles* (replacing the chapter called *Road Vehicles*) is entirely rewritten, with new illustrations. *Forging Hammers and Drop Forging Plant* is rewritten and enlarged; the "Heating" section of *Heating, Ventilation and Air Conditioning* has been rewritten; *Heat, Optics, etc.*, and the chapter on *hydraulics (Mechanics of Fluids)* have been extensively revised. *Units of Measurement* has also had major revision.

Noteworthy additions to other sections of the book contain reference to: purifiers and filters for liquids and air; developments in bearing materials; arc-air cutting and stud-welding guns; electrolytic grinding and metal deposition; wood preservatives and treatment; road construction, foundations, surfacings; water storage and yield from reservoirs, compensation water, design data for concrete dams; railway rails and rail fastenings; and many other subjects.

PRINCIPLES OF MANUFACTURING MATERIALS AND PROCESSES. By James S. Campbell, Jr. 674 pages; 6 by 9 inches; illustrated. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, \$9.75.

This engineering text presents the subject of manufacturing materials and processes in a most efficient and effective manner, by pointing out the basic principles involved, and bases its approach on these principles, tying it in with other courses previously studied, such as chemistry and physics. The book proposes to advance the reader's ability in problem solving, stimulate his creative thinking, and present a challenge.

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INTRODUCTION TO THE KINEMATIC GEOMETRY OF GEAR TEETH. By Allan H. Candee. 204 pages; 6 by 9 inches. Published by Chilton Co., Book Division, 56th and Chestnut Sts., Philadelphia 39, Pa. Price, \$12.50.

This book presents information and explanations of tooth contact on spur gears in suitable form for use in reference and study. Although none of the problems treated are new, the solutions are obtained by thinking geometrically in a way that should appeal to the practical-minded.

A graphical method is employed that consists of geometrical constructions by lines and points, combined with numerical calculations, of distances and angles. Although principles and methods have long been known that cover all phases of gear-tooth action, modern ideas in the geometrical kinematics of mechanisms are applied in practical ways that in many instances are original with the author. In practical work the information wanted often consists of small differences between tooth profiles, resulting from small variations and changes. Diagrams are used in which attention is directed to the small distances rather than to the much larger dimensions like diameters, radii, and center distance. It is then possible to derive simple formulas that yield acceptably accurate values by comparatively short arithmetical calculations. General equations of curves are shown only when they are easily derived and simple in form.

Tables of recently computed co-ordinates of points on the involute of a circle and on involute tooth profiles are presented in an appendix. Rectilinear coordinates for laying out a profile curve are referred to the tangent line and the normal line at a chosen point on the profile. Circular coordinates, consisting of a value x along a chosen circle and a value y in the radial direction, form two sides of an "involute triangle" and simplify determinations of tooth

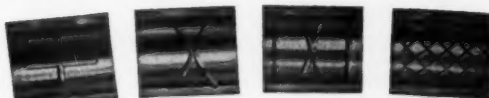
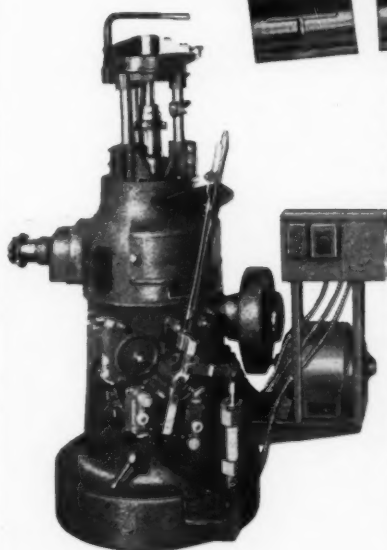
thickness, backlash, and the effects of change of center distance.

Introduction to the Kinematic Geometry of Gear Teeth should be helpful to all individuals interested in toothed gearing.

THEORY OF METAL CUTTING. By Paul H. Black. 204 pages; 6 by 9 inches; illustrated. Published by McGraw-Hill Book, Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, \$7.50.

This book analyzes the metal-cutting operation. It collects and interprets the theories and conclusions concerning what happens at and near the point of a cutting tool. Although the mechanism of metal-cutting is complex, a step-by-step consideration of the elements of the process provides an instructive picture which supplies quantitative information on metal-cutting specifications. The treatment is fundamental and should be of help in specifying machining operations and schedules to increase

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AMERICAN STANDARD MINIATURE SCREWS, ASA B18.11-1961. 11 pages; 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, \$1.

This standard establishes head types, their dimensions, and lengths of slotted-head miniature screws,

threaded in conformance with American Standard Unified Miniature Screw Threads, ASA B1.10. Preferred diameter-pitch combinations for general use are shown in bold type in the tables.

Coming Events

MAY 1-2 — Forty-third Annual Meeting of the American Zinc Institute, to be held at the Drake Hotel, Chicago, Ill. For more details, con-

tact G. M. Basford Co., 60 E. 42nd St., New York 17, N. Y.

MAY 22-25—Design Engineering Show, to be held in Cobo Hall, Detroit, Mich. For further detail, inquire of Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 22-26—ASTME Tool Show, to be held in New York Coliseum. For additional information, contact Leonard Abrams, American Society of Tool and Manufacturing Engineers, 10700 Puritan Ave., Detroit 38, Mich.

SEPTEMBER 28-29—Fourth Annual National Conference and Technical Exhibit of the American Production and Inventory Control Society, to be held at the Pick-Congress Hotel, Chicago, Ill. For more details, contact American Production and Inventory Control Society, 330 S. Wells St., Chicago 6, Ill.

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Hydraulic Servo School Conducted by Vickers Incorporated

A customer training school devoted to the design of electro-hydraulic servo systems and their integration into machine tools, fabricating machines, and processing equipment was recently conducted by Vickers Incorporated, Division of Sperry Rand Corporation, Detroit, Mich. The one-week course included a comprehensive coverage of hydraulic principles in servo circuits, servo valves, torque motors, servo actuators, feedback devices, amplifiers, power supplies, and mixer circuits.

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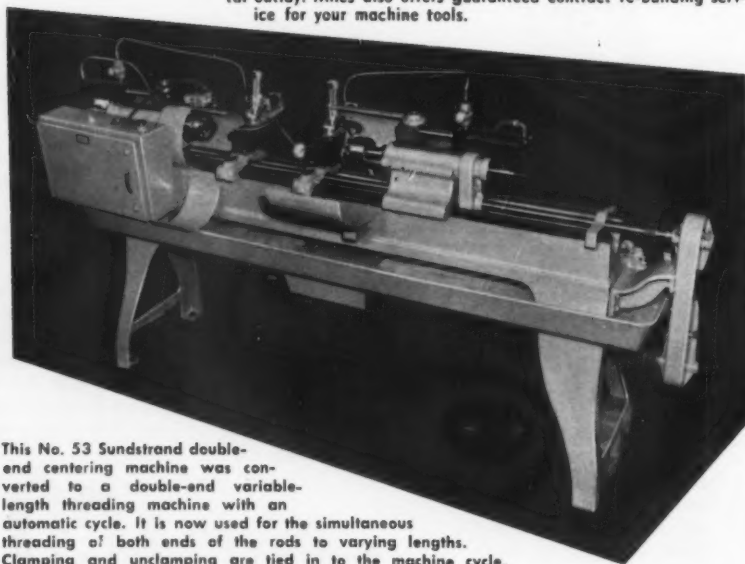
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"It's Your Move," a color motion picture dramatizing the principle of continuous flow in materials handling, has been announced by the Conveyor Equipment Manufacturers Association. This principle is illustrated with a wide variety of examples—from bulk handling of coal and gravel to automated processes used in manufacturing. The film reveals the versatility employed in solving difficult materials handling problems, shows the benefits of automation, and unveils to youth the opportunities in creative engineering in the conveyor industry. Prints of this twenty-four-minute film are available by writing to the association at 1 Thomas Circle, Washington 5, D. C.

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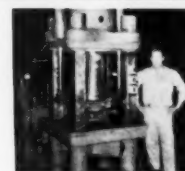
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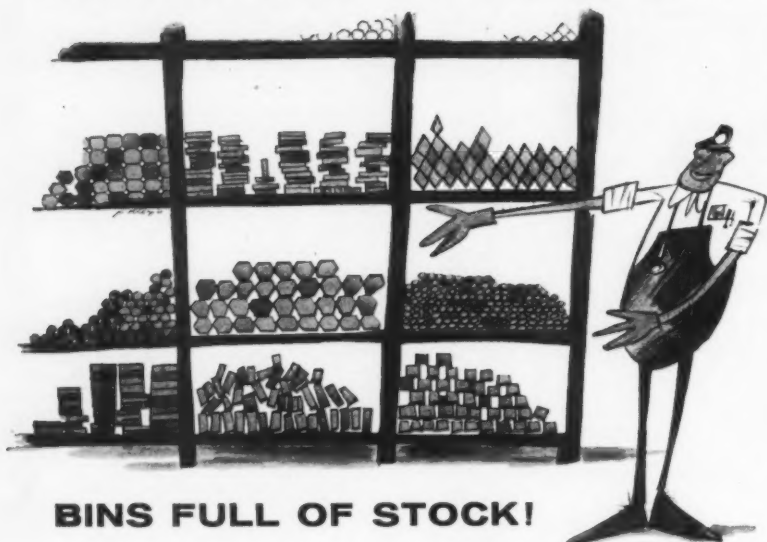
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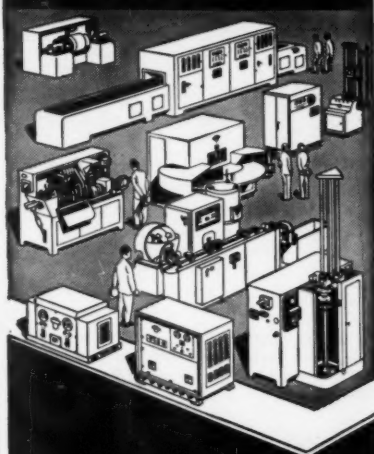
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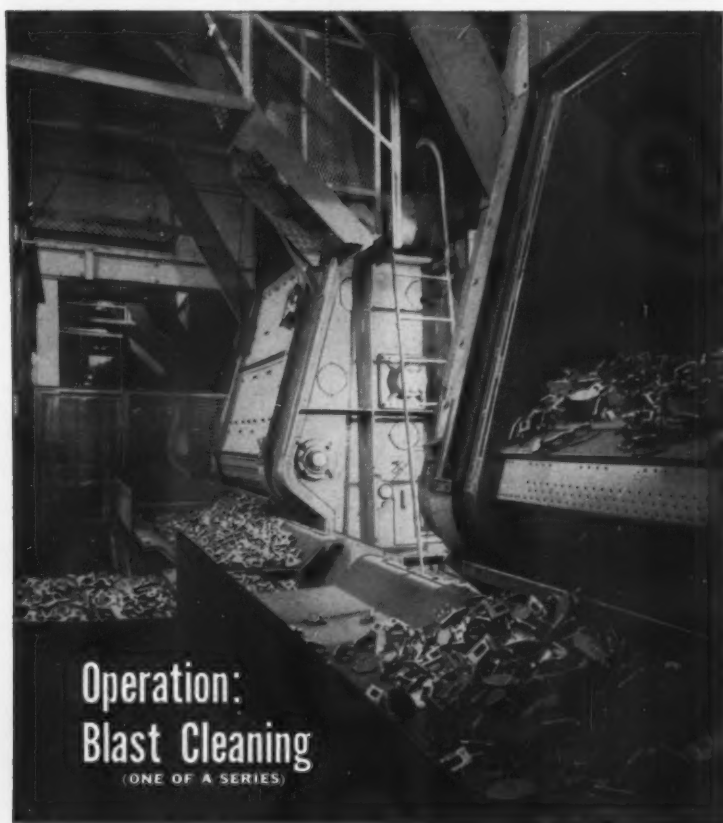
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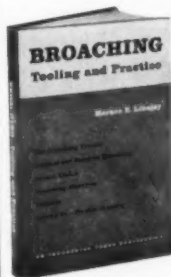
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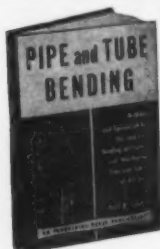
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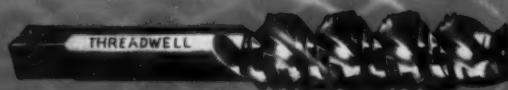
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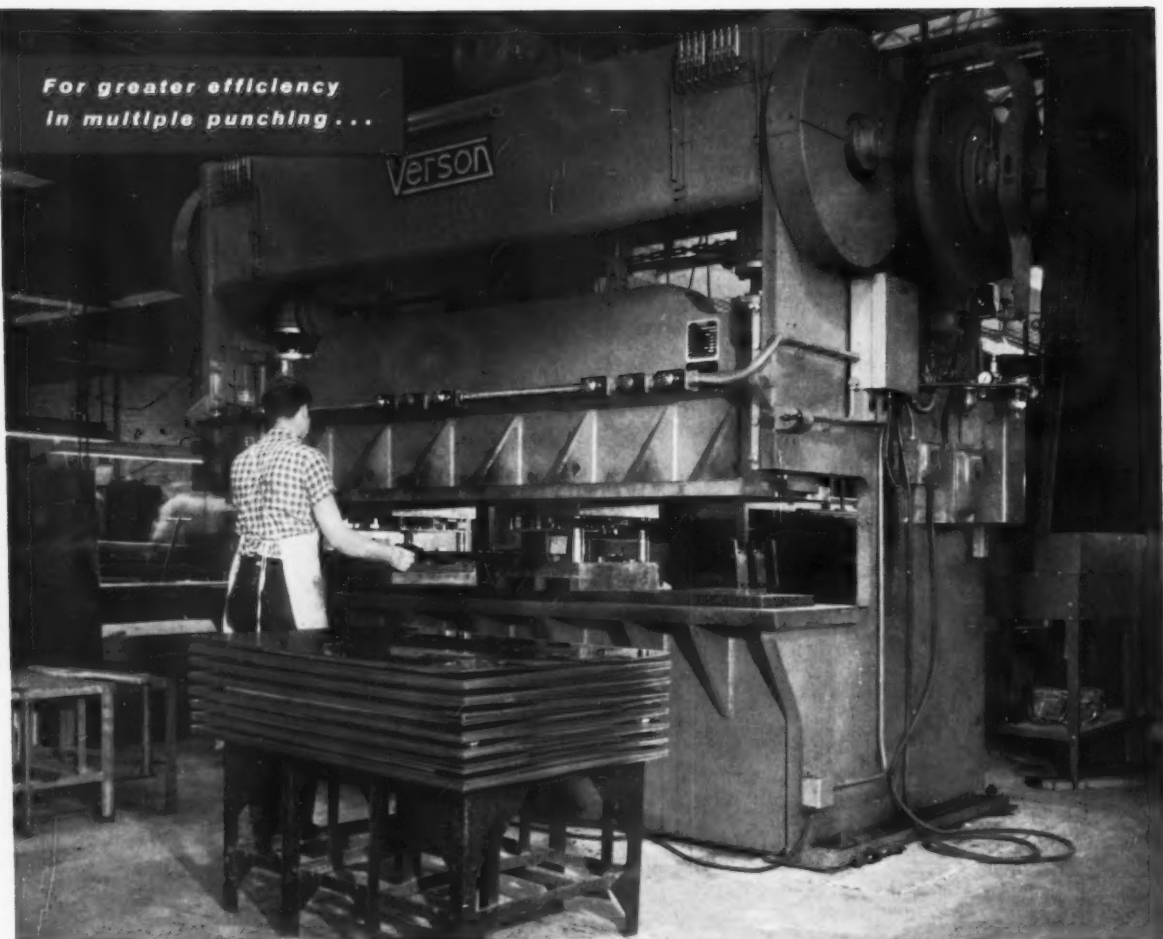
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